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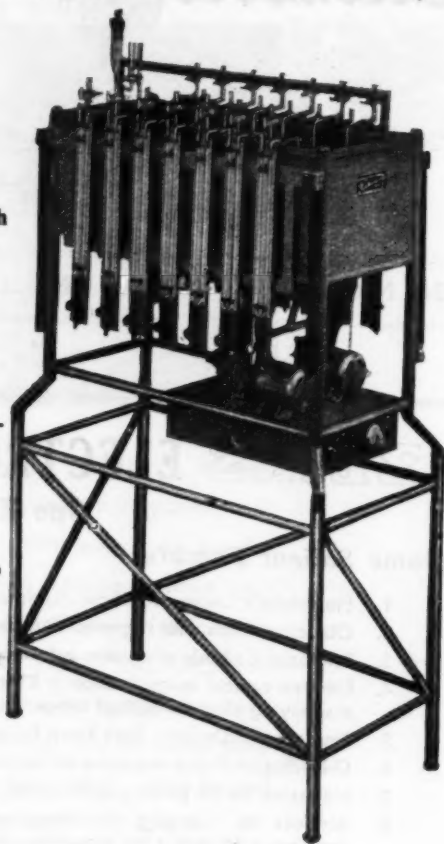


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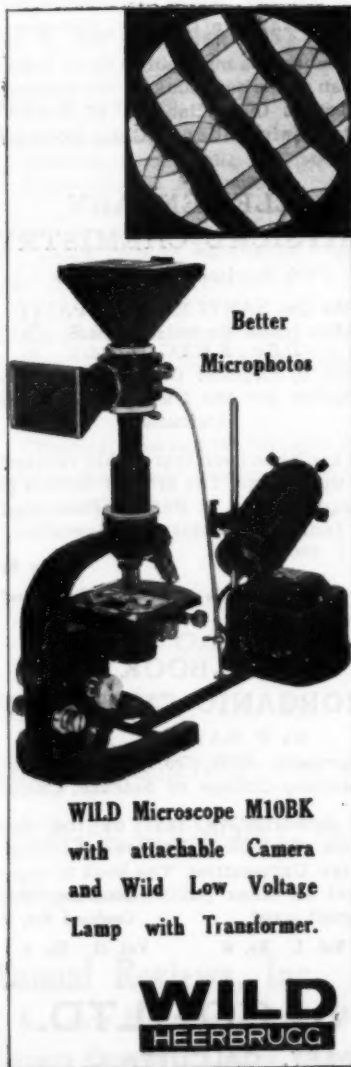
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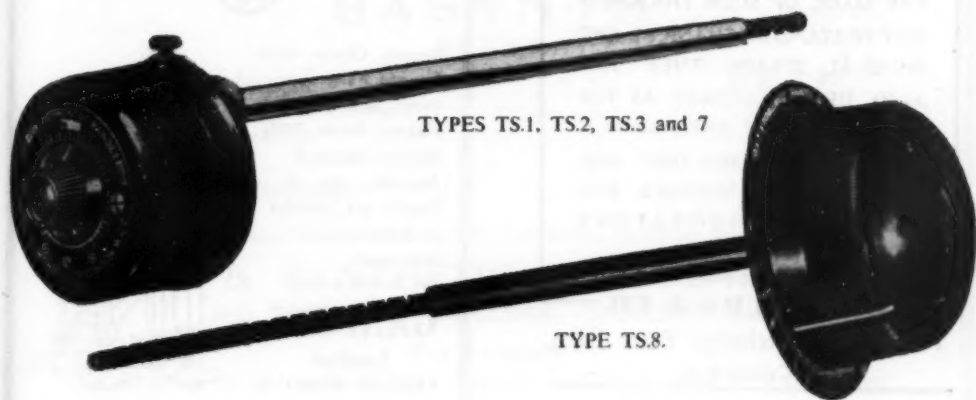
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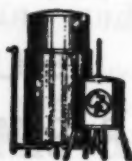


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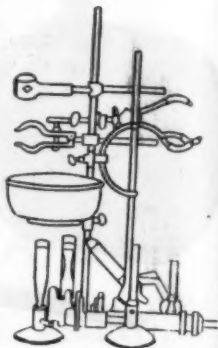
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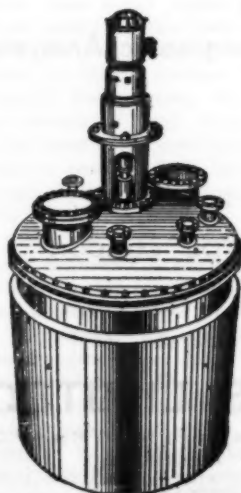
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[No. 6

	PAGE		PAGE
<i>Atomic Power and World Economy</i> ..	183	<i>Structure of Chromosomes</i> ..	188
<i>Lady Tata Memorial Trust Scholarships and Grants for 1955-56</i> ..	184	<i>Geometrical Mechanics and De Broglie Waves—D. S. KOTHARI AND F. C. AULUCK</i> ..	189
<i>Anti-Bacterial Activity of Rauwolfia Alkaloids—M. SIRSI AND M. O. TIRUNARAYANAN</i> ..	185	<i>Beryllium-7 from Cosmic Rays</i> ..	189
<i>Use of Heavy Water in Organic Chemistry</i> ..	186	<i>Letters to the Editor</i> ..	190
<i>Recent Researches in the Palaeontologic Division, Geological Survey of India—M. R. SAHNI</i> ..	187	<i>Reviews</i> ..	211
		<i>Science Notes and News</i> ..	214

ATOMIC POWER AND WORLD ECONOMY

PRIME MINISTER NEHRU has recently pointed out that underdeveloped countries like China and India cannot attain a high standard of living on the basis of coal and oil alone, and the only solution to this difficulty is provided by atomic energy. Even in highly industrialized Switzerland, the water power that has served so well and so cheaply is nearing the limit of its development and future power will be costly if it is based on imported coal transported over long distances. The only alternative is atomic power.

Thus, there are indications that a new era of power is beginning in almost every country in the world. In this connection, it is gratifying that the United Nations has unanimously adopted a proposal for establishing a new international agency for international co-operation in developing the peaceful uses of atomic energy. When organized it will probably be a Specialized Agency of the United Nations similar to the World Health Organization (WHO), the Food and Agricultural Organization (FAO), and the UNESCO. The United States has kindly agreed to make available to

the proposed U.N. agency 220 lb. of fissionable material, i.e., nuclear fuels, which could suffice for 15 research reactors, while 44 additional pounds would be made available by the United Kingdom. These would form an initial capital of energy-packed atoms for the operation of the future U.N. atomic energy agency.

Much interest centres round the forthcoming conference on August 8, 1955, when scientific delegates from some 80 countries will meet to study the technical and scientific factors involved and to explore the means required to develop atomic power on an international scale. Dr. H. J. Bhabha of India will be the President of the Conference, and Dr. Walter J. Whitman of the United States has been appointed Secretary-General.

A new world-picture is expected to emerge from that meeting. Authoritative surveys will be made of the world's power requirements between the years 1975 and 2000, including the needs and resources of specific regions and countries that are not yet industrialized, of others that are in transition from agricultural to industrial economy, and of countries that

are already industrial. Other sessions will discuss the availability of the raw materials for atomic fuels, the economics of nuclear power, the safety and health factors involved in atomic installations, the production and use of isotopes in industry, medicine and agriculture, and the legal problems involved. There will also be more technical sessions on the design and operation of nuclear reactors of various types, and on the fundamental facts and principles of chemistry, physics and biology upon which future developments must depend (including medical research on protection against radiation damage). A final session will discuss measures for the assistance of individual countries in the use of atomic energy, and the technical education of the experts who will be needed. The result will be a worldwide design for the peaceful uses of atomic energy and atomic materials.

But the promise of atomic power is so great that many countries are not waiting for United Nations action, but have already begun active developments. The Soviet Union has announced that the world's first electric power station to make practical use of atomic energy was put into operation on June 27, 1954. It generates 5,000 kilowatts of power for the use of neighbouring industries and agriculture, and larger stations, with a capacity of 50,000 to 100,000 kilowatts are under construction. In Great Britain, a 50,000 kilowatt atomic power station was begun in May 1953, at Calder Hall in Cumberland, and is expected to be in operation early in 1956. In the United States, where coal, oil and natural gas are both plentiful and cheap, it is not expected that electricity from atomic energy can be economical in competition with present power sources, but a 60,000 kilowatt plant is nevertheless being built near Pittsburgh at a cost of \$30,000,000 in the hope that actual experience in its operation will

result in a speedy reduction of future costs. Reports on these existing plants will undoubtedly be made at the Geneva Conference.

Yet very few nations have had actual experience in the full-scale operation of atomic reactors or of atomic power plants. The most immediate need is for information and training to spread the technology required on a wide scale. In order to construct reactors and carry on useful creative research in this field, not only is it necessary to have technical information on the subject—much of it already available—but one must also have scientists, engineers and technicians trained, at least to some degree, in the use and interpretation of these extremely complicated research tools.

This need has already been recognized in the United States, where a School of Nuclear Science and Engineering was opened at the Argonne National Laboratory near Chicago on March last. Thirty-one advanced students from 19 nations, and nine from the U.S. itself, have been admitted to this establishment. They have now begun a seven month study course in the design, construction and operation of reactors for nuclear research; in the principles of design of nuclear power reactors; in the handling of irradiated materials; and in other peaceful applications of nuclear energy. A series of additional courses will also be organized during the coming 12 to 15 months to bring essential basic knowledge and training to a total of 250 specialists from foreign nations. These additional courses are to be in industrial hygiene, in atomic biology and medicine, and in the techniques of using radioactive tracers. The U.S. proposals thus anticipate the future establishment of a United Nations atomic energy agency, and go beyond the direct generation of atomic power to the scientific and medical activities that must accompany it.

LADY TATA MEMORIAL TRUST SCHOLARSHIPS AND GRANTS FOR 1955-56

THE Trustees of the Lady Tata Memorial Trust announce on the death anniversary of Lady Meherbai Dorabji Tata, 18th June 1955, the awards of Scholarships and Grants for the year 1955-56.

The international awards of varying amounts (totalling £6,675) for research in diseases of the blood with special reference to Leucæmias are made to Doctors J. F. Kieler, J. Ringsted, J. Rygaard, N. A. Stenderup, F. Kissmeyer-Nielsen (all of Denmark), J. Nordmann and M. Seligmann (France), Professor H. Teir and Dr. C. G. V. Wasastjerna (Finland), Mr. S.

Joseph and Dr. Alice Stewart (England) and Dr. A. Sreenivasan (Bombay).

Indian scholarships of Rs. 250 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering from disease are awarded to Mr. N. A. Nityananda Rao (Bangalore), M. T. K. Sundaram (Madras), Doctors Prem Nath Satsangi and Satish Chandra (Lucknow), Dr. Mahendra Kumar Trambaklal Mehta (Patna) and Dr. Gangadhar Vyankatesh Bhide and Mr. U. W. Kenkare (Bombay).

ANTI-BACTERIAL ACTIVITY OF RAUWOLFIA ALKALOIDS

M. SIRSI AND M. O. TIRUNARAYANAN

Pharmacology Laboratory, Indian Institute of Science, Bangalore-3

RAUWOLFIA has come to occupy a prominent place in the therapeutics of high blood pressure¹⁻³ and psychic disorders.⁴⁻⁷ While the use of this plant in hypertension is only of recent origin, the root had been employed for centuries in Indian medicine for the relief of various central nervous derangements, both psychic and motor, including anxiety, excitement, maniacal behaviour associated with psychosis and epilepsy. Removal of corneal opacities has been observed when the juice from the leaves of the plant were instilled into the eyes.⁸ *Rauwolfia* has also been considered as specific for bowel disorders, including diarrhoea, dysentery and cholera. It has also been used as an anti-pyretic.⁹

Since this plant, *R. serpentina*, is mentioned as being very commonly used for bowel disorders, it is rather strange that no mention has been made as to the probable usefulness or otherwise of the drug in these clinical conditions, in spite of the intensive research work going on for the past ten years. Since specific remedies in the form of antibiotics and sulpha drugs are already available for such ailments, attention has probably been diverted towards hypertension and mental conditions for which no specific cure is yet available. However, it is known that many alkaloids possess antimicrobial activity, and have been used for various protozoal infections as specific remedies, e.g., quinine in malaria, emetine in amoebic dysentery, and some of them also possess antibacterial activity.¹⁰

The alkaloids from the root were extracted with ammoniacal ethylene dichloride, the extract evaporated to dryness *in vacuo*, and the crude total alkaloids thus obtained were extracted with alcohol, filtered and once again dried *in vacuo*. The crude alkaloids have been found to be pharmacologically active in our other studies.^{11,12} Reserpine, a pure crystalline alkaloid, was also investigated for its antibacterial properties. An 1% solution of the crude alkaloids in alcohol and a similar solution of reserpine in propylene glycol-alcohol-water mixture (1:1:2) were initially prepared from which further required dilutions were made. In every case, controls were run with the solvents alone. Results are presented in Tables I and II.

All the strains of organisms used were obtained from the King Institute of Preventive

TABLE I
Bacteriostatic action of *Rauwolfia* alkaloids
in vitro

Substance	Test Organisms							
	<i>Staph. aureus</i>	<i>Esch. coli</i>	<i>Eberth. typhosum</i>	<i>Eberth. paratyph. A</i>	<i>Eberth. paratyph. B</i>	<i>Shig. sonnei</i>	<i>Shig. flexneri</i>	<i>Shig. shiga</i>
Total alkaloids:								
1:10 dilution	22	18	16	12	20	23	10	12
1:100 dilution	20	13	15	11	17	13	10	10
Alcohol (solvent used above for)	-	13	15	11	10	-	-	-
Reserpine	13	-	-	-	-	-	-	-
1:10 dilution								
Propylene glycol (solvent for reserpine)	12	-	-	-	-	-	-	-

Figures indicate zone of inhibition in mm.; - = No inhibition of growth.

TABLE II
Antitubercular activity of *Rauwolfia* alkaloids
(Youman's media: Surface culture method)
H₃₇R_v strain. Readings at the end of 3 weeks

Concentration 1 in	Total alkaloids	Alcohol (solvent for total alkaloids)	Reserpine	Pr. Glycol mixture (solvent for reserpine)
1,000	-	-	-	-
10,000	-	-	++	++
100,000	+	++	++	++
1,000,000	++	++	++	++
Control	++	++	++	++

- = No growth; + and ++ various grades of growths.

Medicine, Guindy, Madras, except the H₃₇R_v strain of *Mycobacterium tuberculosis* var. *hominis* which was received from the National Collection of Type Cultures, Colindale, England. Youman's medium was used to evaluate the antitubercular activity by surface culture technique.¹³ Filter-paper discs, saturated with drugs to be tested and placed on seeded plates of nutrient-agar and blood-agar, were used to determine the inhibitory action on other microorganisms.

The results may be summarised as follows:

- (a) the total alkaloids have activity against all the organisms tested.
- (b) *Staphylococcus aureus* and *Shigella sonnei* are more susceptible than the other organisms.
- (c) reserpine in 1/10 dilution has no antimicrobial property.
- (d) no appreciable difference in the inhibitory concentration is noticed between the alkaloids and the solvents used against *Myco tuberculosis* H₃₇R_v. Hence, the alkaloids can be considered to be without anti-tubercular activity.

It is particularly significant that the total alkaloids inhibit the growth of *Staphylococci* and *Shigella sonnei*. Many outbreaks of diarrhoeas are, of late, being attributed to these two organisms, and hence, the use of *Rauwolfia* decoctions in such conditions may be explained. However, controlled clinical trials are essential to translate the "in vitro activity" to therapeutic use.

Thanks are due to Ciba Pharmaceuticals, Inc., Basle, for generous supply of reserpine ('Serpasil') and to the Himalayan Drug Co., for the roots of *Rauwolfia serpentina* (Benth.). The authors wish to thank Dr. K. P. Menon for valuable advice.

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USE OF HEAVY WATER IN ORGANIC CHEMISTRY

IN the organic synthesis section, Division of Pure Chemistry, National Research Council, Canada, the following organic compounds labelled with deuterium have been synthesized for use in chemical kinetics, photochemistry and spectroscopy.

(1) Decomposition of the carbide Mg_2C_3 with deuterium oxide gives an excellent yield of propyne-d, $CD_3C \equiv CD$. Several other compounds can be prepared from this material. For instance, chlorination gives 1, 1, 2, 2-tetrachloropropane-d₄, $(CD_3CCl_2CDCl_2)$ from which, in turn, 1, 1, 2-trichloropropene-d₂ or *cis*- and *trans*-1, 2-dichloropropene-d₁ can be prepared.

(2) Addition of deuterium bromide to a double or triple bond is another simple method of introducing deuterium into organic compounds. Thus acetylene-d₂ gives a quantitative yield of 1, 2-dibromoethane-d₄. Alternatively, deuterium bromide may be reacted with ordinary acetylene to give 1, 2-dibromoethane-1, 2-d₂. It has been possible to transform both of these compounds into others, e.g., ethylene-d₄, ethyl-d₅ bromide, ethylene-d₄ oxide, etc.

(3) Deuteration of organic compounds can also be effected by exchange. Such reactions are catalysed by finely divided metals such as nickel or platinum. For example, benzene is easily deuterated to benzene-d₆ by repeated exchange with deuterium oxide in the presence of platinum black. Exchange reactions may

also be catalyzed by acids or bases. Trichloroethylene readily exchanges its hydrogen for deuterium when heated with deuterium oxide containing a weak base. An example of an acid-catalyzed reaction is the conversion of malonic acid to malonic-d₂ acid-d₂, namely, $CD_2(CO_2D)_2$.

(4) Sometimes it is more expedient to prepare a compound by reacting a suitable starting material with deuterium oxide and then enriching the product by exchange. For example, about 20 exchanges are required to convert acetone to acetone-d₆. Considerable time is saved by just preparing deuterated acetone (about 90%) from deuteroacetylene and then enriching it by exchange with heavy water.

The greatest difficulties are encountered in the synthesis of compounds labelled with deuterium in a specific position. A discerning choice of starting material must often be made. For instance, when it recently became necessary to prepare butene-1-4, 4, 4-d₃, $CD_3CH_2CH=CH_2$, the problem was solved by reacting the halide $CCl_3CH_2CHBrCH_2Cl$ with zinc and acetic acid-d. In another case, acetaldehyde labelled in the formyl group was prepared by applying Nef reaction to the deuterated nitroethane, $CH_3CD_2NO_2$. The formation of the acetaldehyde-d, disproved a mechanism proposed for the Nef reaction in 1950. These synthetic methods are being extended in several directions. (*N.R.C. Res. News*, Vol. 8, No. 2).

RECENT RESEARCHES IN THE PALÆONTOLOGIC DIVISION GEOLOGICAL SURVEY OF INDIA*

M. R. SAHNI

Palæontologist, Geological Survey of India

THE present article gives a short review of the various items of research carried out in the Department of Palæontology, Geological Survey of India, during the period of the First Five-Year Plan.

INVERTEBRATES

1. ORBITOLINES FROM THE INDIAN CONTINENT, TIBET AND PAKISTAN AND AGE OF THE ASSOCIATED VOLCANIC SERIES

M. R. Sahni and V. V. Sastri have made an exhaustive investigation of the orbitolines so far collected from Chitral, Gilgit, Kashmir, Central Himalaya and Tibet. These include, beside the new genus *Birbalina* (genotype *B. pulchra*, sp. nov.) allied to *Orbitolinella* Henson, the following new species and varieties: (a) Chitral: *Orbitolina chitralensis* (Aptian-Lower Cenomanian); (b) Gilgit: *O. cf. chitralensis*; (c) Kashmir: *O. kashmirica* (Aptian-Albian); (d) Tibet: *O. obesa*; (e) Burma: *O. raoi*, *O. wadii* and *O. hukaungensis*.

As a result of detailed study, the authors conclude that the volcanic sequence in the Burzil Valley, Kashmir, should be equated to the Panjal Trap Series, not the Tertiaries, as proposed by Wadia, for such Tertiary genera as *Dictyoconoides*, *Alveolina*, etc., supposed to occur in the Burzil Valley sequence, were not found in any of the rock samples, while the so-called *Dictyoconoides* formerly identified in the Cretaceous sequence, are undoubtedly *Orbitolina*.

A detailed account will be published as a Monograph in the *Palæontologia indica*.

2. NEW FOSSILS FROM THE JURASSIC ROCKS OF JAISALMER, RAJASTHAN

M. R. Sahni and N. C. Bhatnagar have investigated a Callovian fauna from Jaisalmer including the following: Genus *Jaisalmeria*, nov. (genotype *J. taylori*, sp. nov.). Generic Diagnosis: beak more or less erect, free of the dorsal umbo, characterised by well developed, sometimes sharply angular, submesothyril beak ridges; deltidial plates probably disjunct; ornamentation consisting of numerous, fine, radiating lines.

Jaisalmeria taylori sp. nov.: shell broadly oval, somewhat depressed but almost equi-

convex, biphlicate. Beak small, erect, obliquely truncated by a small foramen. *Jaisalmeria depressa* sp. nov.: shell depressed, sub-pentagonal, incipiently biphlicate, beak small, erect, beak-ridges well defined, enclosing a broad area below. *Jaisalmeria ovalis* sp. nov. var. *cuneata*, nov. is posteriorly narrow and possesses incipient dorsal sulcation separated by folds.

? *Kutchithyris jaisalmerensis* sp. nov.: shell ovate to subpentagonal; strongly biphlicate, sub-fimbriate; beak massive, well incurved; beak-ridges permesothyril; foramen large.

Hemicidaris jaisalmerensis sp. nov.: test small, circular around the ambitus. Oral surface flat, apex arched; ambulacra almost straight, poriferous zone straight or very slightly flexuous; pore pairs unigeminal becoming bigeminal near the peristome; inter-ambulacral areas wide; madreporic plate pentagonal; ocular plates small, triangular, exsert; genitals comparatively large, pentagonal.

3. NEW UNIONIDS FROM THE TRIASSIC (GOND- WANA) ROCKS OF TIHKI, VINDHYA PRADESH AND MALERI, HYDERABAD, DECCAN

M. R. Sahni and A. P. Tiwari have described for the first time, the only known Triassic unionid fauna from India. This includes the new genus *Tihkia* with much thickened shell, inconspicuous, anteriorly situated (not terminal) beaks, curved inward and forward; flat, smooth umbo; lunule, opisthodontic ligament and characteristically strong concentric corrugations in later stages. Pseudocardinals prominent.

Species: *T. corrugata*, with sharp upward anterior curvature moderate inflation, prominent, elongate opisthodontic ligament. *T. navis*: inflated, subquadrate, boat-shaped. *T. compressa* is broadly oval and compressed. *T. subangulata* is subtriangular and characterised by an oblique external ridge.

4. DISCOVERY OF *Eurydesma* AND *Conularia* HORIZONS IN THE EASTERN HIMALAYA AND DESCRIPTION OF THEIR FAUNAS

M. R. Sahni and J. P. Srivastava record the discovery of *Eurydesma* beds in Sikkim, E. Himalaya and of a *Conularia*-bearing horizon in the Subansiri Division, N.E.F. Agency. The Sikkim fauna represents the Agglomeratic slate horizon of Kashmir with which the beds are lithologically identical.

* Published by permission of the Director, Geological Survey of India.

The Subansiri fauna includes *Conularia laskeri* sp. nov. and the new genus *Subansiria*, combining characters of *Syringothyris* and *Pseudosyrinx*. A detailed account of the fauna is being published in the Inaugural Volume of the *Journal of the Palaeontological Society of India*.

5. A LOWER MIOCENE (GAJ) FAUNA FROM TRAVANCORE-COCHIN, SOUTH INDIA

M. R. Sahni and M. V. A. Sastry have investigated a fossil assemblage (coll.: A. Damodaran) from Edavai, the Travancore coast, homotaxial with Quilon Limestone fauna. The assemblage includes: *Antillia miocenica* sp. nov. with a simple, turbinat, slightly curved corallum; thin, dentate septa disposed in six systems and five incomplete cycles, and a columella. *Calamophyllia miocenica* sp. nov. has a cylindric corallite with mural thickenings, and a few wavy, thin, rounded costae; the septa are wide apart and there is no distinct columella.

The presence of *Breynia carinata*, *Discors trifurcata* and *Tectus loryi* reported for the first time from this part of Peninsular India, confirms that the Quilon beds are of Gaj (Lower Miocene) age.

VERTEBRATES

6. A NEW CLASSIFICATION OF THE INDIAN DEINOTHERES AND DESCRIPTION OF

D. orlovii sp. nov.

M. R. Sahni and C. Tripathi have studied the entire *Deinotherium* material in the Geological Survey collections. A new species, *D. orlovii*, has been established on the characters of its upper dentition, P³ and P⁴ being characterised by additional tubercles not seen in any other Indian species. M² in *D. pentapotamiae* is

square, whereas in *D. orlovii* it is transversely elongated. This is a special character of the upper molars of *D. orlovii*. On the basis of new material, *D. indicum* var. *gajense* has been placed in synonymy with *D. pentapotamiae* and *D. sindiense* with *D. indicum*. *D. pentapotamiae* and *D. indicum* considered synonymous with each other and with *D. giganteum* by earlier workers, are here regarded as independent species.

D. pentapotamiae and *D. indicum* are separable on jaw characters. In *indicum*, the mandible bulges out on either side below M₃ yielding a nearly circular section, which is laterally compressed in *D. pentapotamiae*. There are also differences in their dentition. All the lower teeth of *D. indicum*, except P₃ possess a tubercle each on their outer sides. In M₁ a tubercle is found only at the outer entrance to the valley between the proto- and meta-lophids while in M₂ and M₃, the transverse valley made by the proto- and meta-lophids is guarded by tubercles on both sides. The lower dentition of *D. pentapotamiae* lacks this character.

Both in *D. sindiense* and *D. indicum*, M₃ and M₂ are characterised by tubercles at the entrances to the valley between the proto- and meta-lophids. Similarly, *D. indicum* var. *gajense* was based on an M₃ found in *alveolus*. Other type specimens of *D. indicum* var. *gajense* do not show any difference from *D. pentapotamiae*, a conclusion supported by the new material at our disposal.

D. pentapotamiae ranges from Gaj to Chinji and *D. indicum* from Kamli to Dhokpathan, while *D. orlovii* is known to occur only in the Kamaliais.

STRUCTURE OF CHROMOSOMES

PROFESSOR HANS RIS of the Wisconsin Zoology Department has evolved a valuable theory on the internal structure of chromosomes. The findings which led to Prof. Ris' theory were made with the electron microscope which showed that chromosomes are made up of many tiny fibrils coiled like a corkscrew and about 25 millimicrons thick.

Though a great deal is known about the chemical composition and properties of chromosomes, Prof. Ris' effort to describe their internal structure will help enormously to explain how chromosomes are put together and why they behave the way they do. It has also been noticed that the chromosomes in many different types of plant and animal cells all have fibrils of the same width as basic units.

During cell division, chromosomes split lengthwise, and each half goes to a daughter cell—furnishing the master pattern which the daughter cells follow in growing into a likeness of the parent. By this means, old cells of tissues and organs are replaced with new young cells identical in structure and function. Division is also the means by which sperm cells and ova are created, each containing the chromosomal master pattern of a parent, which merge to produce an offspring with characteristics of both parents. During the process of cell division, the tiny fibrils apparently enlarge until they are twice as thick—or 50 millimicrons—and then split lengthwise, thus giving rise to two new fibrils.

GEOMETRICAL MECHANICS AND DE BROGLIE WAVES*

HAMILTON'S dynamical method is familiar to mathematical physicists, but his optical method seems to be known only to those interested in the theory of optical instruments. This method deals with rays and waves in three-dimensional space. Synge, by extending this method to space and time, has developed a general and completely relativistic theory of de Broglie waves.

Hamilton's theory starts from a variational principle $\delta \int v ds = 0$, where v is a medium-function or index of refraction, depending on position and direction, and from this principle one can construct the properties of rays and waves associated with them. This theory involves neither wavelength nor frequency. Maxwell's theory, on the other hand, starts from a set of partial differential equations and the solution of any optical problem depends upon the exact solution of these equations with suitable boundary conditions. In between these methods there lies what we call physical optics, which takes Hamilton's theory and extends it by adding the concepts of wavelength, secondary waves and interference. Exactly the same thing could be done with the relativistic geometrical mechanics. Newtonian mechanics is based on the principle of Maupertuis $\delta \int v ds = 0$, where v is given in terms of energy by $\frac{1}{2}mv^2 = E - V$. By incorporating the idea of de Broglie waves, we get what we may call "Physical Mechanics" which bears the same relation to Schrödinger wave mechanics as does physical optics to Maxwell's theory.

After a historical discussion given in the first chapter Synge introduces the concept of a medium-function $f(x, a)$ which is a positive homogeneous function of position co-ordinates x_r ($r=1, 2, 3, 4$; $x_4 = ict$) and a unit 4-vector a_r , such that $a_r a_r = -1$, $a_4 t_i > 0$. Rays in space-time are defined as curves satisfying the variational principle $\delta \int f(x, d) ds = 0$, for fixed end-points, ds being the Minokowskian element, so that $ds^2 = -dr, dx_r$. From this he has developed a general theory of rays and waves in space-time. By taking suitable forms for the medium function Synge has dealt with the geometrical mechanics for a free particle, a particle in a field, a charged particle in a given electromagnetic field, and de Broglie waves for a particle in a central field of force.

Chapter IV deals with the process of 'quantizations' which means that the adjacent events A and B of equal phase on a ray satisfy the relation

$$\int_A^B f ds = h.$$

This leads to the well-known fine structure formula for the hydrogen atom, and also a formula for the energy levels of a hydrogen-like atom in a weak magnetic field. The last chapter deals with some generalizations of the theory, developed in the previous chapters, to N-dimensional space.

The reviewers have enjoyed reading the book and can confidently recommend it to those interested in this subject of great physical interest.

D. S. KOTHARI.
F. C. AULUCK.

* *Geometrical Mechanics and de Broglie Waves*. By J. L. Synge, Cambridge University Press, 1954, pp. 167, 25 s.

BERYLLIUM-7 FROM COSMIC RAYS

IN his classic paper of 1946 (*Phys. Rev.*, 1946, 69, 671), W. F. Libby predicted the existence of cosmic-ray-induced radioactivities in the atmosphere, in particular C^{14} , with a half-life of 5600 yr. and tritium, with a half-life of 12.4 yr. Both nuclides have now been discovered and used to study a wide variety of processes having time-scales comparable to their respective half-lives. Carbon-14 is made by low energy neutron capture in nitrogen, whereas tritium results chiefly from high-energy interactions, or "stars".

Two other nuclides may be expected to re-

sult from these high-energy interactions in nitrogen and oxygen. These are Be^7 with a half-life of 53 days, and Be^{10} with a half-life of 2.5×10^6 yr. Because of their well-spaced half-lives, these species should be of geochemical interest. The discovery of Be^7 produced by cosmic rays has been reported by James R. Arnold and H. Ali Al-Salih in *Science* (1955, 121, 451). The authors observe that interestingly enough Be^7 is the easiest of all the cosmic-ray-produced nuclides to detect, despite its comparatively low production rate, because it occurs substantially carrier-free.

LETTERS TO THE EDITOR

	PAGE		PAGE
Investigation of Vertical Movements of the F_2 Layer—N. V. GURUNADHA SARMA	190	Niheritance of Resistance to Wilt (<i>Fusarium lini</i> Bolley) in Linseed—R. B. DESHPANDE AND L. M. JESWANI	202
Temperature Dependence of the Magnetic Susceptibility of Sodium and Potassium—K. VENKATESWARLU AND S. SRIRAMAN	191	A Chromatographic Study of the Amino Acids (and Sugars) of Healthy and Diseased Leaves of <i>Acalypha indica</i> —M. M. LALORAYA, GOVINDJEE AND T. RAJA RAO	203
Beneficiation of Vermiculite—N. R. SRINIVASAN AND R. K. RAMA MURTHY	192	External Morphology of the Soldier of <i>Odontotermes obesus</i> (Rambur)—K. S. KUSHWAHA	203
The Benzophenanthridine Ring System—K. K. MATHEW, B. S. PAI AND K. N. MENON	193	Abnormal Arrowing in <i>Erianthus murja</i> (Roxb.), Jesw.—S. L. SHARMA AND R. C. SRIVASTAVA	204
Monofluoro-Arsenates and Their Analogy with Sulphates—N. K. DUTT AND A. K. GUPTA	193	Cytological and Embryological Investigations in the <i>Asclepiadaceae</i> —INDU SEKHAR BISWAS	204
Choline Content of Some South Indian Foodstuffs—K. DAKSHINAMURTI	194	Environment and Rate of Growth of Embryo in <i>Brassica campestris</i> var. <i>toria</i> —Y. R. AHUJA	205
Spectrophotometric Study of the Kinetics of Ferric Thiosulphate Reaction—D. PATNAIK AND G. N. MAHAPATRA	195	Unequal Bivalent in <i>Eurybrachis</i> (Fulgoroidea Homoptera)—S. R. VENKATASUBBA RAO	206
Micro-method for Estimation of Nicotine Group of Alkaloids in Tobacco Plants—B. C. BOSE, H. N. DE AND I. H. DALAL	196	Effect of Nutrition and Starvation on the Susceptibility of <i>Corcyra cephalonica</i> Staint. to Carbon Disulphide—SNEHAMOY CHATTERJI	206
Distribution of Tasters and Non-Tasters and A-B-O Groups—A. KRISHNA RAO	197	Chromosome Numbers in <i>Sesbania</i> Species—M. S. PAWAR AND S. A. KULKARNI	207
Efficacy of Proguanil and Dihydrotriazines as Antimalarials—C. P. NAIR, B. G. MISRA, H. L. BAMJI AND A. P. RAY	197	Metallic Complexes formed by Diphenyl-Violuric Acid—R. P. SINGH	208
Comparative Activity of Reserpine and Total Alkaloids of <i>Rauwolfia</i> —J. D. KOHLI AND B. MUKERJI	198	A New Organic Reagent for Gravimetric Estimation of Copper—R. P. SINGH	208
An Unusual Record of <i>Tenia</i> with a Single Circle of Hooks from a Dog—L. S. HIREGAUDAR AND S. R. RAO	199	Occurrence of Scolytid Beetle on Stored Sweet Potatoes—T. R. SUBRAMANIAN	209
Protein Catabolism in the Developing Egg of <i>Pila virens</i> —(MISS) V. R. MEENAKSHI	199	Septoria Leafspot of <i>Manilkara hexandra</i> —M. KANDASWAMY AND N. V. SUNDARAM	210
Crustacean Wood-Borers of Visakhapatnam Harbour—P. N. GANAPATI AND R. NAGABHUSHANAM	200	Wilt of Gram (<i>Cicer arietinum</i> L.) in Bihar—J. N. MISHRA	210
Cellulase Activity of the Crystalline Style of the Wood-Boring Pelecypod <i>Bankia indica</i> Nair—N. BALAKRISHNAN NAIR	201		

INVESTIGATION OF VERTICAL
MOVEMENTS OF THE F_2 LAYER

PERIODIC fading of short wave radio signals in the early morning and late evening hours was interpreted by the previous workers^{1,2} as due to the interference of two waves either singly and doubly reflected from one layer or singly reflected from two different layers (E and F_2) when one or both the layers have a slow vertical movement. When the received signal consists of singly reflected waves from both the layers, they have assumed that both the

layers will move with the same velocity. Since the F_2 layer is known to have larger height variations than the E layer, it is felt that the assumption made above is not quite justified. So, by taking the vertical velocities of the two layers to be different, the formula was modified from which the F_2 layer velocity can be determined by substituting the previously known value of the E layer velocity obtained from medium wave records taken during the same time. The modified formula takes the form

$$n = (2/\lambda) (v_1 \cos \phi_1 - v_2 \cos \theta_1)$$

where n is the fading frequency, λ is the wavelength of the received signal, ϕ_1 and θ_1 are the angles of incidence of the two rays on the F_2 and E layers of the Ionosphere and v_1 and v_2 are the respective vertical velocities of the two layers. Substituting the E layer vertical velocity obtained from medium wave records taken separately during the same time, we can easily calculate v_1 if we determine the periodicity in a short wave fading record.

Madras B transmitting station radiating on 4920 Kc/s. was selected and the signals were recorded with the usual c.w. recording technique in the evening hours at about 6 O'clock and it was found that the condition was favourable to receive both the singly reflected waves from the two layers. The average value of the layer lifting velocities for the E layer during the month of October 1953, in the evening hours was found to be 2.3 metres/s. Using this value the layer lifting velocities for the F_2 layer obtained on three typical days are shown in the table.

S. No.	Date	Period in secs.	Velocity m./s.
1	8-10-53	14.7	3.7
2	8-10-53	16.1	3.45
3	9-10-53	19.4	3.02
4	9-10-53	16.0	3.47
5	10-10-53	18.2	3.16

From the table it is evident that F_2 layer velocity is definitely greater than that of E layer as was expected. More reliable values for F_2 layer velocities can be obtained by taking simultaneous records on short and medium waves from the same station so that the exact E layer velocity during the same time may be determined. The results thus obtained for the F_2 layer velocity can be checked by obtaining records showing periodicities due to the interference of $1F_2$ and $2F_2$ reflections from the layer. The full details of these investigations will be published elsewhere. The author has great pleasure in expressing his gratitude towards Dr. B. Ramachandra Rao for his kind and inspiring guidance.

Ionospheric Labs., N. V. GURUNADHA SARMA.
Physics Dept.,
Andhra University,
Waltair, February 3, 1955.

1. Banerjee, S. S. and Mukerjee, G. C., *Phil. Mag.*, 1948, **39**, 697.
2. Kastgir, S. R. and Das, P. M., *Proc. Phy. Soc.* 1950, **63**, 924.

TEMPERATURE DEPENDENCE OF THE MAGNETIC SUSCEPTIBILITY OF SODIUM AND POTASSIUM

THE study of the magnetic susceptibility of the alkali metals has assumed great interest in recent years because of the theoretical importance from the point of view of the weak spin paramagnetism of the conduction electrons in metals. Several authors have previously studied the susceptibilities of the alkali metals but their values show a large disparity among one another and with the values calculated from theoretical considerations. Also, with regard to the study of the variation of the susceptibility of these metals with temperature, the results so far available are very divergent in nature and as such no definite conclusions could be arrived at.

In the present investigation a study of the susceptibilities of sodium and potassium has been made between room temperature and about 120° C. by the Curie method using a large electromagnet of Pye type. Pure oxide-free metals were used in the test bulbs. Also a correction for any ferromagnetic impurity that might be contained in the metal has been applied for every bulb experimented upon using the method of Honda and Owen.¹ The average specific susceptibility values for Na and K at room temperature as obtained in this investigation are +0.575 and +0.455 respectively.

Three Na bulbs and three K bulbs were subjected to temperature variation from 30° C. to 120° C., i.e., over a short range on either side of their melting points. The heating was done by an electrical heater and the temperatures were measured by a previously calibrated thermo-couple. At every temperature, the susceptibility was found at different field strengths and the correction for the ferromagnetic impurities was applied to each bulb. Table I summarises the values obtained in this investigation.

TABLE I

Sodium		Potassium	
Temperature °C.	$\chi \times 10^6$	Temperature °C.	$\chi \times 10^6$
30	.575	30	.450
50	.575	42	.450
67	.580	58	.460
84	.590	67	.435
94	.600	86	.435
105	.560	105	.440
120	.560		

The results obtained show a slight but definite increase in susceptibility as the melting point is approached. As fusion takes place the values fall down abruptly by a small amount. In the case of potassium a slight increase in the value is observed as the temperature is increased beyond the melting point. These observations are in general agreement with the results obtained by Sucksmith.² The contribution by the free electrons to the susceptibility (χ_A) of a gram atom of Na works out to be 20.12 and (χ_A) for K is found to be 32.78. The width V_0 of the energy band in volts for the free electrons is calculated to be 1.59 and 0.98 for Na and K respectively. This indicates a narrowing of the energy band as suggested by Stoner.³ Fuller details will be published elsewhere.

Dept. of Physics, K. VENKATESWARLU.
Annamalai University, S. SRIRAMAN.
Annamalainagar,
March 8, 1955.

1. Honda, K., *Ann. d. Phys.*, 1910, **32**, 1027.
2. Sucksmith, W., *Phil. Mag.*, 1926, **2**, 21.
3. Stoner, E. C., *Magnetism and Matter*. (Methuen), 1934, p. 510.

BENEFICIATION OF VERMICULITE

VERMICULITE, an alteration product of phlogopite and biotite micas, finds innumerable industrial applications by virtue of its low thermal and electrical conductivity. The mode of occurrence, origin, uses and the methods of beneficiating low grade vermiculite have been reviewed exhaustively in a recent paper.¹ In literature, there is scanty reference to tabling as a means of beneficiation of this mineral. Though heavy media separation has been reported by Sullivan and Bird² and sink-float separation of exfoliated vermiculite by Hidehiko Mino et al.,³ the efficiency of separation in the different size ranges has not been mentioned. Hence work has been undertaken with three samples of vermiculite received from the Mysore Geological Department. The grade of vermiculite is fixed by its bulk density "B.D.", which is the weight in lb./c. ft. of the exfoliated material and its "exfoliation index", which is the ratio of the volume of the original material to the volume of the exfoliated product. The best qualities of vermiculite bulk 6 lb. or less/c. ft. after being exfoliated,⁴ and the average exfoliation index varies from 12-18.⁵

The B.D. and exfoliation index have been determined by heating the sample in a muffle furnace at 982° C. for 5 minutes.⁶

Of the three samples investigated, one was from Bageshpura and the other two from Malavanghatta, designated herein as Malavanghatta I and Malavanghatta II. The first was pale bronze yellow to grey in colour while the other two were pale greyish yellow to black. The samples consisted of coarse lumps together with fines, and screen analyses have been done. The following gangue minerals were found to occur with vermiculite as small granules of irregular shape and in a highly altered condition: quartz, feldspar, hornblende, serpentine, clay, magnetite, laterite, apatite and granitic gneiss.

Tabling experiments were done on a laboratory Wilfley table, with different size fractions (Bulk, +10, -10/+60, -60/+120 and -120 mesh B.S.S.) of the material to study the extent of separation of the value from the gangue. The gangue minerals collected at the concentrate end of the table, while the clay and slime segregated to the tail end leaving a good middling product. In the tabling experiments of the samples with different size-ranges, although there was clear separation of vermiculite from silicate gangue minerals up to +60/mesh, the best grade obtained with the samples was from the +10 mesh fraction. The +10/mesh Bageshpura sample after tabling bulked 9.0 lb./c. ft. with exfoliation index of 5.6 and a recovery of 94.3%. The +10/Malavanghatta I and II samples bulked after tabling 14.9 and 13.7 lb./c. ft. with recoveries of 69.0 and 70.7% respectively.

In the heavy media separation of vermiculite from Bageshpura in the same size-fractions, with bromoform alcohol mixture, sp. gr. 2.52, vermiculite could be floated off from the gangue; owing to the very small difference in specific gravity between the Malavanghatta samples and the gangue, separation was done after exfoliation with carbon tetrachloride, sp. gr. 1.58. In general it has been found that desliming yields a slightly higher grade of vermiculite. The unexfoliated +10 Bageshpura sample after heavy media separation bulked 9.8 lb./c. ft. with 94.6% recovery, while the exfoliated sample after separation bulked 11.2 lb./c. ft. with 73% recovery. The exfoliated Malavanghatta I and II samples after heavy media separation bulked 14.5 and 13.9 lb./c. ft. with recovery of 74.0 and 80.7% respectively. A magnetic separation of the gangue minerals has also been effected.

It has been found that the grade and recovery are good in the +10 fraction, and the sample from Bageshpura appears to be the best of all the specimens. Work on the flotation of vermiculite is in progress. Fuller details will be published elsewhere.

Dept. of Metallurgy, N. R. SRINIVASAN.
Indian Inst. of Science, R. K. RAMIA MURTHY.
Bangalore-3, March 7, 1955.

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THE BENZOPHENANTHRIDINE RING SYSTEM

THE appearance of a paper by Cook, Loudon and McCloskey¹ in the current issue of the *Journal of the Chemical Society* prompts us to place on record results connected with an allied work. 7-Methyl-tetra-hydroquinoline was condensed with o-nitro-benzyl chloride yielding N-(o-nitrobenzyl)7-methyl-1, 2, 3, 4-tetrahydroquinoline (C: 72.5, H: 6.6). The corresponding amino-derivative could not be purified even though it gave all the common tests for a primary aromatic amine. The crude oily base was dissolved in dilute sulphuric acid, diazotised, freshly precipitated copper powder added and slightly warmed when a vigorous evolution of nitrogen took place. The resulting tarry mass yielded no basic material. We then turned our attention to the corresponding nitro-benzoyl derivative and work was in progress when the abstract of a paper by Mitsuhashi² reached us. The Japanese author had observed that the diazotisation of o-amino-benzoyl-arylamines results in triazole condensation instead of Pschorr reaction. He suggested that if the imino hydrogen of the acid-imino group is replaced by a benzyl group, Pschoff reaction would occur. In support of this he effected the cyclization of o-amino-benzoyl-N-benzyl-aniline. The ring closure of o-amino-benzoyl-carbazole by Plant and Tomlinson³ is of interest in this context. We therefore decided to apply the Mitsuhashi hypothesis to the benzophenanthridine series. O-Nitro-benzoyl-chloride reacted with N-

benzyl-a-naphthylamine to give the amide m.p. 161 (C: 75.1, H: 4.7). The corresponding amine was diazotised and treated with copper powder to yield N-benzyl-benzophenanthridone, m.p. 252 from alcohol (C: 85.2, H: 5.1). The corresponding benzophenanthridones using o-nitro-veratric acid and o-nitropiperonylic acid respectively were obtained fairly easily. 6-Nitro-veratroyl-N-benzyl-a-naphthylamine, m.p. 138 from alcohol (C: 70.3, H: 5.0) yielded the amino derivative, m.p. 149 from alcohol (C: 75.4, H: 6.0) and then the 2, 3-dimethoxy-N-benzyl-11-keto-benzophenanthridine, m.p. 196 from alcohol, (C: 78.7, H: 5.5). 6-Nitro-piperonyl-N-benzyl-a-naphthylamine, m.p. 180 (C: 70.8, H: 4.5), was reduced, diazotised and ring closed to give 2, 3-methylenedioxy-N-benzyl-11-keto-phenanthridine, m.p. 190-dec. (C: 79.6, H: 4.5). Work in this field and in the allied pyrrocoline group has been resumed after an unavoidable break in continuity.

Dept. of Org. Chemistry, K. K. MATHEW,
University of Madras, B. S. PAL,
Madras-25, K. N. MENON.
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MONOFLUO-ARSENATES AND THEIR ANALOGY WITH SULPHATES

CHEMICAL analogy between monofluorophosphates (PO_3F) and sulphates are well known from the researches of Lange¹ and Goswami.² As P and As show close analogies in the phosphates and arsenates, search for analogous fluo-derivative of As, that is, fluo-arsenate (AsO_3F) has been deemed necessary. A note on the existence of such fluo-arsenates was published by G. Mitra³ recently. He however failed to prepare any pure salt, simple or double. He simply observed the formation of mixed crystals by isomorphous replacements by various compounds, e.g., ZnSO_4 (AsO_3F) $7\text{H}_2\text{O}$, etc. A method different from that of Lange has been described by Audrieth⁴ in his "Inorganic Synthesis" for the preparation of (PO_3F). Following this method using potassium meta-arsenate and potassium fluoride, we have been able to prepare potassium fluo-arsenate $\text{K}_2\text{AsO}_3\text{F}$ in quantity directly. Other alkali metal salts and bivalent metal salts were

prepared by double decomposition between the potassium salt and the corresponding metallic perchlorates. The salts of Na, K, Co or Cd have been prepared and analysed.

Preparations of other simple and also double salts including alums are in progress.

Our best thanks are due to Prof. P. B. Sarkar for kindly suggesting the problem.

Inorg. Chem. Lab., N. K. DUTT.
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CHOLINE CONTENT OF SOME SOUTH INDIAN FOODSTUFFS

The importance of choline as a nutritional factor has been recognised for long. Fatty livers and hæmorrhagic kidneys in rats and mice and perosis in chicks and turkeys have been ascribed to a dietary deficiency of

choline.¹ Choline deficiency as an ætiological factor in human fibrosis of the liver has been repeatedly affirmed.²⁻⁷ Information on its distribution in foodstuffs is limited. K. Ahmed *et al.*⁸ and H. Chattopadhyaya and S. Banerjee⁹ have determined the choline content of some common foodstuffs in Bengal. The possibility of a variation in the chemical composition of foodstuffs grown in two distant regions cannot be ruled out. So a determination of choline in some of the more common South Indian foodstuffs was made.

Samples of the food material were collected from the Vellore market at different periods of the year. They were dried free of moisture and powdered. Two methods of extraction were tried and both gave a complete extraction of choline. In the first 2-10 g. of the material containing 4-8 mg. choline was extracted continuously for 24 hours with 50-100 ml. of methyl alcohol in a Soxhlet extractor. In the second the material was extracted with 10 times its weight of 70% ethanol by grinding in a mortar. The method used for the estimation of choline in the extract was essentially that of Engel.¹⁰

TABLE I
Total choline of South Indian foodstuffs

Name	Choline content expressed as choline chloride on dry basis (mg./100 gm.)		
	Present Investigation	K. Ahmed <i>et al.</i> ⁸	H. Chattopadhyaya and S. Banerjee ⁹
CEREALS, PULSES AND NUTS			
Wheat (<i>Triticum vulgare</i>)	69.8 (± 1.1)*	..	70 (± 1.8)*
Polished Rice (<i>Oryza sativa</i>)	44.8 (± 1.4)	88	70 (± 1.8)
Rice Polishings	nil	..	..
Cholam (<i>Sorghum vulgare</i>)	41.9 (± 0.9)	..	..
Ragi (<i>Eleusine coracana</i>)	16.9 (± 0.8)	..	..
Cambu (<i>Pennisetum typhoides</i>)	38.2 (± 1.4)	..	..
Maize (<i>Zea mays</i>)	nil	..	nil
Dhall Arhar (<i>Cajanus indicus</i>)	147.5 (± 1.5)	209	261 (± 2.2)
Bengal Gram (<i>Cicer arietinum</i>)	225.2 (± 1.1)	215	245 (± 1.6)
Green Gram (<i>Phaseolus radiatus</i>)	139.1 (± 1.2)	185	205 (± 2.5)
Black Gram (<i>Phaseolus mungo</i>)	137.5 (± 1.4)	232	99 (± 1.5)
Horse Gram (<i>Dolichos biflorus</i>)	189.5 (± 1.8)	..	..
Bean (<i>Dolichos lablab</i>)	148.6 (± 1.5)	391	..
Peas (<i>Pisum sativum</i>)	206.2 (± 0.8)	280	..
Cow Gram (<i>Vigna catieng</i>)	215.5 (± 1.5)	..	..
Groundnut (<i>Arachis hypogea</i>)	177.5 (± 1.5)	244	..
VEGETABLES			
Brinjal (<i>Solanum melongena</i>)	276.0 (± 1.0)	1145	..
Potato (<i>Solanum tuberosum</i>)	32.52 (± 0.4)	400	..
Yam (<i>Typhonium trilobatum</i>)	22.85 (± 0.4)	..	..
Colocasia antiquorum	64.73 (± 0.9)	..	..
Sweet potato (<i>Ipomoea batatas</i>)	nil	..	..
Plantain Green (<i>Musa paradisiaca</i>)	14.78 (± 0.4)	..	..
Cabbage (<i>Brassica oleracea capitata</i>)	125.5 (± 0.5)	1500	..
Tomato (<i>Lycopersicum esculentum</i>)	76.4 (± 0.8)	..	..
Onion (<i>Allium cepa</i>)	82.5 (± 0.5)	..	..

* Values given in brackets represent standard deviation of the result.

Choline reineckate was determined by a photoelectric colorimeter using the yellow green (520 mμ) filter, and calibration was done using pure choline chloride. The colorimetric method was found to be suitable for estimation of choline in the range of 2-10 mg. Recovery experiments were done by adding a known quantity of choline chloride to a sample of the biological material and estimating the total choline. The recovery was of the order 98-101%.

The values given in Table I and compared with values reported in literature represent an average of over 30 individual estimations in each case. It is seen from Table I that the cereals and the more common vegetables are low in choline. Maize and sweet potato do not contain any choline at all. Unlike the vitamins of the B group, no choline is lost during polishing rice.

It is a pleasure to express my thanks to Dr. S. C. Devadatta, for his advice and interest in the work.

Dept. of Biochemistry, K. DAKSHINAMURTI.
Christian Medical College,
Vellore, South India,
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SPECTROPHOTOMETRIC STUDY OF THE KINETICS OF FERRIC THIOSULPHATE REACTION

The coloured intermediate produced by the reaction of thiosulphates with ferric salts has been assigned the formula FeS_2O_3^+ by Schmid,¹ Haldar and Banerjee,² Page³ and Ricca and Faraone.⁴ The rate of decay of this labile-coloured intermediate has been studied spectrophotometrically in the visible region. The plot of percentage of transmission against time gave the familiar S-shaped curves and the plot of optical density against time produced similar curves but turned upside down. Fig. 1 shows typical results obtained at 5000 Å, when 6 c.c. of M/100 solution of sodium thiosulphate were

added to equal volume of M/100 ferric chloride solution containing N/10 hydrochloric acid.

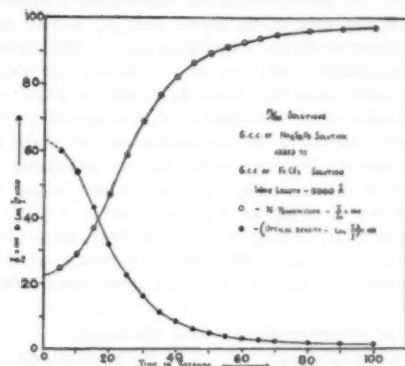
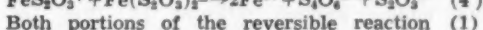
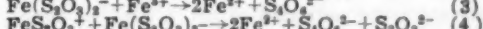
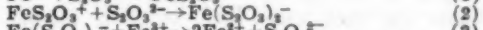


FIG. 1

These curves clearly show that the rate of decay increases gradually, attains a maximum value and then falls off with time. The curves can be extrapolated to give the percentage of transmission or the optical density at zero-time. The general characteristics of the curves do not change with the purity of the materials and water used or with the change of wavelength in the visible region. Using very dilute solution of ferric perchlorate in perchloric acid, the general characteristics of the curve have been observed even in the ultraviolet region. While at high ionic strength the shape of the curve is unaffected, presence of excess of hydrogen ions greatly suppresses the marked acceleration in the rate. Addition of cupric ion or increase in the concentration of thiosulphate ion simply accelerates the rate of decay. The nature of the curves warrants that the decay of the coloured FeS_2O_3^+ should involve an intermediate for which we propose the formula $\text{Fe}(\text{S}_2\text{O}_3)_2^-$. This second intermediate should not be identified with the coloured intermediate of Holluta and Martini⁵ now established to be FeS_2O_3^+ .

We propose the following mechanism for the decay reaction of the coloured intermediate FeS_2O_3^+ or as a matter of fact for the ferric thiosulphate reaction:



Both portions of the reversible reaction (1) have been shown by Schmid to be very fast and therefore, the rate of decay will depend on the comparatively slower reactions (2), (3) and (4). It is evident that at zero-time, when the

concentration of FeS_2O_3^+ is maximum, that of $\text{Fe}(\text{S}_2\text{O}_3)_2^-$ is nil.

It can be predicted from the above mechanism that the rate of decay of FeS_2O_3^+ would not be maximum at the beginning but would attain the maximum value after a period of time. This expectation has been fulfilled. Further, it can be said that the rate of reduction of ferric ion and the rate of consumption of thiosulphate would behave similarly in attaining a maximum value after a time which may be termed as the period of induction.

The kinetic equation as derived from our mechanism along with the discussion of the experimental results will be published elsewhere.

Dept. of Chemistry,
Ravenshaw College,
Cuttack-3,
November 18, 1954.

D. PATNAIK.
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MICRO-METHOD FOR ESTIMATION OF NICOTINE GROUP OF ALKALOIDS IN TOBACCO PLANTS

IN our investigation on the study of biogenesis of nicotine group of alkaloids in the tobacco plants by *in vitro* tissue culture technique, difficulties were first encountered in selecting a suitable micromethod by which small amount of nicotine could be accurately measured. As no such method was reported in the literature a suitable micromethod based on the cyanogen bromide and aniline colour reaction as applied in case of nicotinic acid estimation by Swaminathan¹ and Melnick,² has been developed to measure nicotine group of alkaloids in the above plants.

In this method the nicotine alkaloids were distilled off from tobacco leaves powder in alkaline medium by steam and collected in 5 ml. of 1:1 hydrochloric acid upto a definite volume of 300-500 ml. To 1 ml. of this distillate was then added 1 ml. of 50 ml. sodium acetate buffer adjusted to pH 7, 2 ml. of aqueous aniline solution followed by 12 ml. of cyanogen bromide solution, mixed well and after 10 minutes the colour was matched against a suitable standard of nicotine solution by using photoelectric colorimeter.

The per cent. of nicotine determined by this method (3-2% of dry leaves) almost corresponded with that obtained by titration method in which nicotine distilled off from alkaline medium was absorbed in 5 ml. of N/10 sulphuric acid upto 500 ml. and the total alkaloid determined by back titration against N/10 sodium hydroxide.

Taking different batches of leaf samples varying from 2 g.-40 mg. it was noted that the small amount of nicotine as present in 40-50 mg. of leaves corresponding to 2 µg. of nicotine per c.c. of the distillate collected, could be accurately estimated by this method. In case of lesser amount below 2 µg. per ml. the intensity of colour developed was too faint to give any appreciable deflection in the galvanometric scale of the colorimeter. Process of "intensification of the colour" by adding 2 mg. of nicotine to both unknown and standard helped to measure even lesser amount of nicotine below 2 µg.

Accuracy of the method was further evaluated from the experiment on the per cent. recovery in which it was noted that 1 mg. of nicotine mixed with tobacco leaf powder and distilled in the usual way, gave a recovery to the extent of 96-98%.

Investigation on the effect of distillate volume on per cent. recovery showed that at distillate collection of 100-200 ml., recovery of nicotine in the distillate was only 60-70%. Maximum recovery of 96-98% was obtained at the distillate volume of 300 ml. and above.

This micromethod has been successfully utilised in our investigation on the study of the biogenesis of nicotine alkaloid in different parts of tobacco plants by *in vitro* tissue culture technique with various amino acid precursors and the results will be communicated in due course.

The present method is not only suitable for nicotine estimation but also for all other pyridine alkaloids like nor-nicotine anabasine, etc., and further investigations are in progress to apply this method for the estimation of all the pyridine group of alkaloids by separating these by paper and column chromatographic techniques.

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M.G.M. Medical College, H. N. DE.
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DISTRIBUTION OF TASTERS AND NON-TASTERS AND A-B-O GROUPS

THE inability to taste phenylthiourea is transmitted as a Mendelian recessive, and has been variously assessed¹⁻³ between 5 and 30%.

The present investigation was undertaken to get an idea of the percentage of 'tasters' and 'non-tasters' amongst the students of Kasturba Medical College coming from all parts of India. First a 1 in 20,000 dilution was chosen. A small quantity of the solution was put into the mouth of each person who was asked to tell the taste. While many gave clear-cut replies, some were doubtful about the taste. So, a higher concentration, i.e., 1 in 10,000 was tried. At this dilution all of them gave an answer one way or the other.

The A-B-O grouping of each student was also estimated by the standard slide technique using high titre Blood Grouping Sera. One hundred and fifty-five students were tasted in all, of whom 60.6% were tasters and the rest non-tasters. The distribution per cent. of the A, B, O and AB groups was respectively 23.9, 28.4, 40.0 and 7.7.

The distribution of tasters and non-tasters in the different blood groups is given in Table I.

TABLE I

	A	B	O	AB	Total
No. of Tasters ..	26	26	35	7	94
No. of Non-tasters ..	11	18	27	5	61
% of Tasters ..	70.3	59.1	56.5	58.3	60.6
% of Non-tasters ..	29.7	40.9	43.5	41.7	39.4

It is interesting to note that a dilution of 1 in 10,000 proved sufficient for the sampling. We are unable to confirm the findings of Ford¹ that both types can usually tell the taste in concentrations of 400 parts per million. A few of the non-tasters were given the phenylthiourea powder itself to taste. They were not able to tell the taste.

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EFFICACY OF PROGUANIL AND DIHYDROTRIAZINES AS ANTIMALARIALS

ISOLATION of an active dihydrotriazine metabolite of proguanil¹ (I; X = Cl) stimulated interest in the field of dihydrotriazines as potential antimalarials.²⁻⁵ During the course of synthesis⁴ and testing^{6,10} of similar compounds, it was considered worthwhile to obtain a comparative picture about the efficacy of proguanil, its active metabolite and a similar dihydrotriazine (I; X = SO₂NH₂) which has been claimed⁶ to be very promising. Bioassay of these compounds against *P. gallinaceum* was undertaken following the technique adopted by Jaswant Singh *et al.*⁷; while against *P. knowlesi* (Nuri strain), the technique was similar to the one outlined by Nair *et al.*⁸

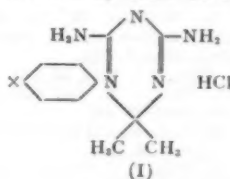


TABLE I

Comparative efficacy of proguanil, its metabolite and 1-p-sulphonamidophenyl-1:6-dihydro-2:4-diamino-6:6-dimethyl-1:3:5-triazine

Drug	Minimum effective dose in mg./kg./b.w.	
	<i>P. gallinaceum</i>	<i>P. knowlesi</i>
Quinine	32.0	35.0
Proguanil	2.0	0.2
Proguanil Metabolite (I; X = Cl)	0.06	35.0
Dihydrotriazine (I; X = SO ₂ NH ₂)	128 to 256	inactive up to 50 mg.

* No clearance of parasite upto 125 mg.

The M.E.D. of quinine against *P. gallinaceum* and the virulent Nuri strain of *P. knowlesi* are nearly equal while proguanil is 10 times more effective against the latter infection. On the contrary, proguanil metabolite (I; X = Cl), in spite of its superiority over the parent drug against *P. gallinaceum*,^{1,10} has given erratic results against *P. knowlesi*. For instance, doses as low as 0.2 g. were effective in some cases, but a consistently effective response⁹ (complete clearance of blood parasites) in at least 5 monkeys could be obtained only with doses as high as 35 mg./kg. body weight. The sulphonamide substituted dihydrotriazine (I; X = SO₂NH₂),

on the other hand, has shown poor response even against the avian plasmodia. When tested against *P. knowlesi* in doses ranging from 5-125 mg./kg. body weight, it failed to clear the blood parasites in all cases. Consequently, it seems unlikely that these two dihydrotriazines, especially the latter, will be suitable for the treatment of acute attacks of malaria.

Malaria Inst. of India,
Delhi-8,
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C. P. NAIR.
B. G. MISRA.
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COMPARATIVE ACTIVITY OF RESERPINE AND TOTAL ALKALOIDS OF *RAUWOLFIA*

Rauwolfia serpentina Benth. has been and is still used in India in the form of crude powder or tablets from crude powder or as solid or liquid extracts containing total alkaloids and the oleo-resinous fractions. With the discovery of 'reserpine', which is claimed to be the main sedative principle of this drug,^{1,2} preparations containing this isolated alkaloid have come to be employed in Europe and America for therapeutic purposes where *R. serpentina* is indicated. Wilkins³ reported that the clinical effects of 1 part of reserpine compared favourably with 1000 parts of *Rauwolfia* root powder. The yield of reserpine being 0.1%, Wilkins' work would indicate that the entire activity of the crude drug might be due to its chief alkaloid 'reserpine'. The following investigation was undertaken to decide whether reserpine alone was responsible for the entire activity of *R. serpentina* or the other constituents of the plant also possessed some activity.

Serpasil ampoules containing 2.5 mg. reserpine per ml. were used for the pure principle and 'Serpina' tablets containing total alkaloids of *R. serpentina* were used for the crude drug.⁴ Rhesus monkeys weighing 1,500-1,750 g. were employed in this study. Monkeys were fed orally on empty stomach and observed for 48-72 hours at suitable intervals. The animals were re-employed after a rest period of 10-12 days. Cross-over test was employed for final evaluation of the preparations.

Repeated observations show that 5 mg. of reserpine is equipotent with 6 tablets of Serpina. In these doses, both drugs produce noticeable depression for 36-48 hours. The effect can be appreciated 3-4 hours after medication which becomes maximum in 10-12 hours. At this stage, the monkeys lose total interest in their surroundings. They offer no resistance when disturbed or handled. Diarrhoea occurred in some monkeys with this dose of either drug.

Serpina tablets were analysed for reserpine content following a method reported elsewhere.⁴ They contain 0.38 mg. per tablet so that six tablets would contain 2.28 mg. of reserpine. This work, therefore, shows that reserpine alone is not responsible for the total activity of the drug. Rescinnamine, another alkaloid isolated from *R. serpentina* by Klohs *et al.*,⁵ has been claimed to be the second sedative principle of the plant by Cronheim *et al.*⁶ Quantitatively it is considered to be as potent as reserpine. However, rescinnamine was present only in negligible amounts in 'serpina' tablets. So it is difficult at this stage to say whether there are some other C.N.S. depressant constituent or constituents in *R. serpentina*, or the effect of reserpine is potentiated in the presence of other alkaloids. Anyhow it is quite clear that the C.N.S. depressant activity of *R. serpentina* is not represented in reserpine alkaloid alone.

Some other points of significance that have been noted during the course of this work are: (i) The monkeys require much larger dosage of reserpine than dogs, rabbits, cats, etc. Nearly 3 mg./kg. orally was required to put the monkey to sleep and make them lose interest in surroundings for 12-24 hours. This is in confirmation of findings of Plummer, *et al.*⁷ (ii) Reserpine dissolved in P.A.W. (Propylene glycol: Alcohol: Water, 1:1:4) had greater and quicker effect than when given suspended in water alone, apparently due to quicker absorption from the gut.

Thanks are due to Dr. M. M. Dhar for analysing Serpina tablets for reserpine.

Central Drug Res. Inst.,

J. D. KOHLI.

Lucknow,

B. MUKERJI.

April 11, 1955.

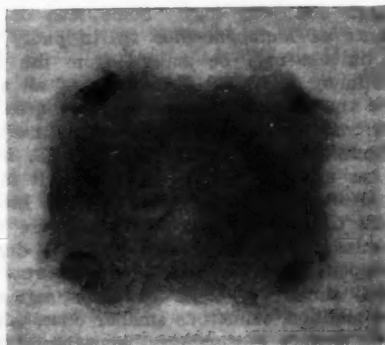
* Serpasil ampoules were kindly supplied by M/s. Ciba Pharma Ltd. Serpina tablets were kindly supplied by M/s. Himalayan Drug Co., Bombay.

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AN UNUSUAL RECORD OF TAENIA WITH A SINGLE CIRCLE OF HOOKS FROM A DOG

THE members of the family Tæniidæ are characterised by the rostellum-bearing two circles of hooks, a single set of reproductive organs and the uterus in the form of a median stem.

Hall¹ divided the genus *Tænia* into three groups, viz., (i) *Tænia* in which the rostellum bears two circles of hooks, (ii) *Tænia saginata* when the head is unarmed, and (iii) *Tænia monostephanos* when the head bears a single circle of hooks. The *Tænia* worms with double circle of hooks are quite common and are found in greater frequency in the dog, cat and man, while those with a single circle of hooks are rare. Linstow² recorded a *Tænia* with a single circle of hooks from a Lynx



(Lynx lynx) in Russia and named it *T. monostephanos*. In this species as reported, the

hooks are without handle and appear rose-thorn shaped. Later Honess³ reported another species, with a single circle of hooks from a badger (*Taxidea taxus taxus*) describing it under the name *Fossor angertrudæ*. In this form the hooks appear to possess well developed guard and are smaller in size when compared with a tæniid hook. Most of the authors are of the opinion that the former is a teratological or traumatic form of *Tænia*. Wardle and Mcleod⁴ have justly remarked that until further specimens of Honess's form are recorded the genus *Fossor* must be regarded sub judice.

During the course of study of tæniid cestodes of dogs and cats from Bombay State, the authors came across a tapeworm possessing a single circle of hooks, instead of two. But the worm was quite indistinguishable morphologically from other *Tænia* excepting for the hooks and the length of the body, which is smaller than *Tænia hydatigena*. The rostellum on closer examination did not show any indication of scar-like tissue, being formed as a result of damage or traumatic injury. The hooks measure 118 μ and resemble the small hooks of the ordinary *Tænia* of dogs in shape and size. The number of hooks encountered is 13 (2 are probably damaged). The length of the body is 250 mm. long. The detailed morphology and the identity of the worm is in progress and will be published elsewhere. This record is of interest because it might throw some light on the possibility of an existence of a *Tænia* with one circle of hooks.

Bombay Veterinary College, L. S. HIREGAUDAR.
Bombay, S. R. RAO.

February 22, 1955.

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PROTEIN CATABOLISM IN THE DEVELOPING EGG OF PILA VIRENS

THE present note reports the study on the nitrogenous waste products in the developing egg of *Pila*. Lal and Saxena² have recently studied the nitrogenous excretion in the adult *Pila*.

Extracts of eggs were prepared and tested for ammonia, urea and uric acid according to the methods given by Hawk, et al.¹ For the

estimation of ammonia the aeration method of Van Slyke and Cullen, for urea the urease method of Van Slyke and Cullen and for uric acid the method of Benedict and Franke was used. Till the third day no trace of nitrogenous waste product could be detected, probably due to the negligible amounts produced. A trace of nitrogenous waste product in the form of ammonia was first observed on the fourth day. Table I gives the result of the analysis at different stages of development after this period.

TABLE I

Age		Ammonia N µg.	Urea N µg.	Uric acid N
4 days	..	16.5	nil	nil
7 days	..	32.6	35.2	nil
8 days	..	28.8	49.0	Traces*
10 days	..	20.2	67.2	Traces*
Just hatched		nil	58.2	Greater amount

* Determined qualitatively.

Pila illustrates Needham's view¹ that the choice between ammonio-, ureo- and urico-telism is determined by the conditions under which embryonic development takes place. It is well known that eggs of *Pila* are not laid actually in water but in moist mud in which situation rapid removal of toxic substances, as they are formed, is not possible as in an aquatic environment. As Lal and Saxena² have shown, there is an alteration of ureotelism and uricotelism depending on whether the animal (which is amphibious) lives in water or out of it. The detoxication of ammonia by its conversion into urea and uric acid is related to life under terrestrial conditions of limited water supply or non-availability of water, as in the case of hibernating animals. In the developing egg the later stages of which are spent under less moist or nearly dry conditions, there is a sequence of ureotelism and uricotelism. This succession is similar to the recapitulatory parallelism described by Needham³ for the chick.

My thanks are due to Prof. R. V. Seshaiya for guidance.

Dept. of Zoology, (Miss) V. R. MEENAKSHI,
Annamalai University,
December 23, 1954.

CRUSTACEAN WOOD BORERS OF VISAKHAPATNAM HARBOUR

In the course of our survey of the marine wood-boring organisms in the Visakhapatnam harbour we noticed decided attacks of wood-boring crustaceans along with molluscan borers. In India very little work has been done on the crustacean wood-borers in spite of economic interest attached to such studies. The only work on the subject is that of Erlanson¹ who reported two species of the Isopod genus, *Sphaeroma*, from Cochin harbour.

We have recognized, so far, three species of Isopod wood-borers belonging to two distinct genera in the local harbour. They are *Metoponorthus* sp. belonging to the family Oniscidae and two members of the family Sphaeromidae (*Sphaeroma terebrans* and *S. walkeri*) commonly termed as 'Pill-bugs'.

Metoponorthus sp. is the most important crustacean borer in Vizag harbour. It measures about 7 mm. in length with a width of 2.5 mm.; abdominal somites rarely coalesced; body flattened; antennules quite vestigial; antennae long, its peduncle bearing five segments; mandible devoid of a palp. The sexes are separate and a small number of eggs are laid by the female to be carried in a brood pouch between the bases of the legs on the underside of the body. The young, when hatched, differ only in size from the adults. While all members of the family Oniscidae so far described are terrestrial in habitat, it is interesting to observe that this is the first record of an oniscid having become marine and developing wood-boring propensity. While these forms are found in large numbers in fishermen's catamarans, only very few were noticed in timber jetties. This may be due to the difference in the types of wood used in catamaran and jetty logs. Some idea of the abundance of *Metoponorthus* sp. in badly infested timbers may be gauged from the fact that as many as 50-100 individuals of all ages may be contained in 3 square inches area.

Sphaeroma terebrans and *Sphaeroma walkeri* are generally found in the jetty logs. *S. terebrans* has a uniform drab dark hue. It measures about 8.5 mm. in length. The hinder segments of the body have a transverse row of prominent tubercles. The telson is decidedly sloped from its base having a row of tubercles similar to those of other segments and, in addition, numerous smaller ones, which give the surface a roughened appearance. In *Sphaeroma walkeri* the telson bears two indefinite longitudinal rows of tubercles and this

1. Hawk et al., *Practical Physiological Chemistry* (Churchill Ltd., London), p. 822.

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3. Needham, J., *Brit. J. Exp. Biol.*, 1926, 4, 114.

structure is more strongly concave with the edges curved upwards than in *S. terebrans*.

Besides these three important wood-boring crustacea another form, *Cirolana* (Cirolaninae) is often collected in wooden jetties in the local harbour. Whether it is actually a wood-borer or whether it merely infests the holes made by other wood-borers is not fully established.

Our grateful thanks are due to Dr. Robert J. Menzies of the Scripps Institution of Oceanography, California, for identifying the Isopods, *Metoponorthus* sp. and *Cirolana*.

Dept. of Zoology,
Andhra University,
March 18, 1955.

P. N. GANAPATI.
R. NAGABHUSHANAM.

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CELLULASE ACTIVITY OF THE CRYSTALLINE STYLE OF THE WOOD-BORING PELECYPOD *BANKIA INDICA* NAIR

It is well known¹⁻³ that the principal diet of the wood-boring teredines is wood. In view of this specialised diet and since the wood particles in the caecum are found to be in a state of dissolution, showing a considerable amount of reducing sugars, it was inferred that the crystalline style may contain a cellulose-splitting enzyme.

To test whether the above assumption is valid, the style extract of *Bankia*, a common shipworm infesting the fishing floats in the Madras waters, was tested for cellulase by Newell's method,⁴ using a suspension of regenerated filter-paper as the substrate and measuring the turbidity in a Klett-Summerson colorimeter using a red filter (wavelength 640 m μ). The reducing sugars formed were estimated by the Somogyi method.⁵ Extracts of 1% (w/v), of the style were prepared by homogenising the style in M/15 phosphate buffer at pH 5.9 which was found to be the optimum pH for style cellulase.

Five tubes A, B, C, D and E were set up each with an equal volume of reaction mixture as shown in Table I.

The decrease in turbidity in the tubes D and E containing the active enzyme is clear from the readings in Table I.

The amount of cellulose left as residue after the action of the enzyme, was estimated on 5 ml. samples and compared with those in which enzyme was not added. It was found that whereas in A and B, 12.3 and 12.6 mg. of cellulose was found, in D and E the amount of

cellulose had decreased to 7.8 and 7.9 mg. respectively due to its hydrolysis into soluble sugars indicating cellulase activity.

Table showing the turbidity readings (Klett-Summerson) for different reaction mixtures

Tube	Hours								
	0	1	2	3	4	6	8	20	
Control 1. A (without enzyme)	225	222	220	222	220	225	220	220	
Control 2. B (boiled without enzyme)	220	220	218	220	216	220	220	220	
Control 3. C (boiled with enzyme)	400	400	396	396	400	398	398	398	
Active 1. D	380	375	360	354	340	330	318	295	
Active 2. E	380	373	364	357	343	327	320	297	

The extent of digestion was also verified by estimating the sugars found as a result of the activity of the enzyme at intervals of 5, 10, 20 and 24 hours on 5 ml. samples. The volume differences in titre values for the above periods were 5.3; 7.0; 8.9 and 9.6 respectively, showing the increase in the amount of sugar formed and the progress of digestion.

A chromatographic analysis was made to determine the end products formed by enzymic hydrolysis of cellulose (details are reserved for a fuller paper) which revealed that cellobiose and glucose are the end products. Since the author has found³ the presence of cellobiase activity in the digestive diverticula of *Bankia*, it is probable that the cellulase liberated by the crystalline style hydrolyses the cellulose into cellobiose first, which is further converted into glucose by the cellobiase of the digestive diverticula. This conclusion is supported by that of Levinson *et al.*,⁶ who found cellobiose as an intermediary in the process of cellulose breakdown in fungal metabolism.

I thank Dr. C. P. Gnanamuthu and Dr. G. Krishnan for help in the preparation of this paper and Dr. P. S. Sarma for laboratory facilities.

Zoology Lab., N. BALAKRISHNAN NAIR.
University of Madras,
April 4, 1955.

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NIHERITANCE OF RESISTANCE TO WILT (*FUSARIUM LINI* BOLLEY) IN LINSEED

RUST, caused by *Melampsora lini* (Pers) Lev., and wilt, caused by *Fusarium lini* Bolley, constitute two serious diseases of the linseed crop over a great part of India. Breeding for rust resistance carried out at this Institute has resulted in the evolution of a number of economic strains immune to rust. One or more of these rust-resistant strains have done better than the local improved strains in many States of India and some States have already taken steps to multiply their seed for distribution to growers.³ The genetics of rust resistance in this crop was reported by Deshpande and Jeswani.²

TABLE I

Showing the wilt reaction in the parents and F_1 's

Parents and F_1 's	Number of plants grown	Number of plants wilted
N.C. 5-2	12	..
N. C. 4-14	17	1
Bison 69	15	..
Bison 70	21	..
Dakota	17	..
Sheynne	16	..
B. 5128	19	..
N.P. (R.R.) 405	23	23
N.P. (R.R.) 407	14	14
N.P. (R.R.) 438	15	13
N.P. (R.R.) 494	18	17
F_1 N.C. 5-2 \times N.P. (R.R.) 494	16	..
F_1 N.C. 4-14 \times N.P. (R.R.) 405	13	..
F_1 N.C. 5-2 \times N.P. (R.R.) 407	21	..
F_1 Bison 69 \times N.P. (R.R.) 438	12	..
F_1 Bison 70 \times N.P. (R.R.) 438	15	..
F_1 Dakota \times N.P. (R.R.) 438	18	..
F_1 B. 5128 \times N.P. (R.R.) 405	16	..
F_1 N.P. (R.R.) 405 \times B. 5128	15	..
F_1 Sheynne \times N.P. (R.R.) 405	22	..

From a survey of the relevant literature, it appears that very little work has been done on the inheritance of resistance to wilt in linseed. Burnham¹ and Dillman,⁴ while observing that resistance to wilt in linseed was an inherited character, did not report any definite Mendelian ratios. Tisdale⁵ failed to find evidence of simple genetic ratios in respect of inheritance of this character and concluded that wilt resistance in flax was apparently determined by multiple factors.

We have recently observed that some strains, which were rust-resistant, also showed a high degree of resistance to wilt. For studying the inheritance of wilt resistance, nine cross-combinations between wilt-resistant and wilt-susceptible strains were effected during 1951-52. A part of the crossed seed was utilised in 1952-53 for growing the F_1 generation at Delhi and seed was collected from these plants for raising the F_2 progenies. During 1953-54, the parental strains and the corresponding F_1 and F_2 progenies were grown at the Institute of Plant Industry, Indore, in a plot made wilt-sick by means of artificial inoculation with the wilt organism. The results obtained are presented in Tables I and II.

The results presented in Tables I and II strongly suggest that resistance to wilt in linseed is an inherited character, resistance being dominant over susceptibility. In the F_2 generation, the progenies from cross Nos. 2, 3, 7 and 8 showed a segregation of 3 resistant : 1 susceptible, while those from cross Nos. 1, 4, 5, 6 and 9 gave the ratio of 15 resistant : 1 susceptible. Although the number of plants per F_2 progeny was rather small, the results clearly indicate that, in the material studied, resistance to wilt is governed by a pair of duplicate genes, resistance being dominant over susceptibility.

We are grateful to the Director, Institute of Plant Industry, Indore, for giving the facilities

TABLE II

Showing the wilt reaction in the F_2 generation

	Cross	Number of plants grown	Number of plants wilted	Expected Ratio	χ^2	P value limits
1.	N.C. 5-2 \times N.P. (R.R.) 494	.. 18	1	15 : 1	0.013	0.95-0.90
2.	N.C. 4-14 \times N.P. (R.R.) 405	.. 26	6	3 : 1	0.073	0.80-0.70
3.	N.C. 5-2 \times N.P. (R.R.) 407	.. 43	13	3 : 1	0.628	0.50-0.30
4.	Bison 69 \times N.P. (R.R.) 438	.. 30	2	15 : 1	0.008	0.95-0.90
5.	Bison 70 \times N.P. (R.R.) 438	.. 21	1	15 : 1	0.081	0.80-0.70
6.	Dakota \times N.P. (R.R.) 438	.. 26	2	15 : 1	0.091	0.80-0.70
7.	B. 5128 \times N.P. (R.R.) 405	.. 30	7	3 : 1	0.044	0.90-0.80
8.	N.P. (R.R.) 405 \times B. 5128	.. 24	5	3 : 1	0.222	0.70-0.50
9.	Sheynne \times N.P. (R.R.) 405	.. 22	2	15 : 1	0.302	0.70-0.50

and to Mr. Merh of that Institute, for arranging for the wilt-resistance tests.

Division of Botany, R. B. DESHPANDE.
Indian Agri. Res. Inst., L. M. JESWANI.
New Delhi, February 15, 1955.

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A CHROMATOGRAPHIC STUDY OF THE AMINO ACIDS (AND SUGARS) OF HEALTHY AND DISEASED LEAVES OF ACALYPHA INDICA

AN attempt has been made to study chromatographically the changes in the amino acid as well as the sugar content of the leaves of *Acalypha indica* (a common weed) due to the yellow mosaic condition of the leaves. The authors observed that the plants show a 'mosaic' pattern in the top leaves whereas the leaves below were quite green and healthy.

Various methods^{1,3} of circular paper chromatography were tried. The best results were obtained by making use of the modification made by Ranjan et al.² A circular piece of Whatman filter-paper No. 1, diameter 27 cm. having 12 equal sectors separated by 12 radial cuts, was used for the purpose. Drops of known volume (0.002 ml.) of both the water extract as well as the acid-hydrolysate were kept at the positions located for the purpose. Index solutions were kept at six different places (A, B, F, H, I and J) to facilitate the identification of the bands.

The chromatogram was run with butanol-acetic acid-water (4:1:5) with a single paper wick in the centre for 7 hours. It was then dried at room temperature (25°C.) and sprayed with 0.1% ninhydrin solution in acetone.

The hydrolysate both of the healthy and mosaic leaves showed the presence of leucine and isoleucine (Band I), valine and methionine (Band II), tyrosine (III), alanine (IV), glutamic acid and threonine (V), glycine and aspartic acid (VI), arginine (VII), histidine and lysine (VIII), cystine (IX), but absence of serine. The water extract in both cases showed the existence of only tyrosine (I), glutamic acid and threonine (II), serine (III), and arginine (IV), but the bands were more intense with the 'mosaic' leaves.

The content of the free amino acids increased in the case of the 'mosaic' leaves. A separate study of sugars by the same method and using aniline-hydrogen phthalate as spraying reagent showed that the sugar content decreased in the case of the 'mosaic' leaves.

We are grateful to Prof. S. Ranjan for his encouragement and to Shri K. S. Bilgrami for his valuable help.

Dept. of Botany, M. M. LALORAYA.
University of Allahabad, GOVINDJEE.
Allahabad, T. RAJA RAO.
December 10, 1954.

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EXTERNAL MORPHOLOGY OF THE SOLDIER OF ODONTOTERMES OBESUS (RAMBUR)

WITH a view to study the detailed morphology of the higher Indian termites, of which none has so far been worked out, *Odontotermes obesus* (Rambur) (Isoptera, family Termitidae) was selected. The external morphology of the soldier caste has been worked out in detail.

The head is of the prognathous type. Some of the cranial sutures present in primitive insects are wanting here. The principal areas of the cranium are the vertex, epicranial region, frons, clypeus, genæ and mandibularia dorsally, and the occiput, postocciput, postgenæ and postmentum ventrally. The tentorium consists of the main body or corporotentorium and two pairs of tentorial arms, the anterior and the posterior.

The antennæ are usually with 16-17 segments, rarely with 15. In some colonies 16-segmented forms, and in others 17-segmented forms, predominate. Many individuals show asymmetry in the number of antennal segments in the right and left antennæ, but the difference is never more than one.

The mandibles are sharp and sabre-shaped. The left mandible bears a small tooth which is generally absent in the right one. The cervix or neck is provided with two pairs of cervical sclerites, an anterior and a posterior one.

The thorax is well developed, especially the pronotum. There are two pairs of thoracic spiracles, one pair each on the meso- and metathorax. The legs are slender, the hind leg being the longest. The tarsi are 4-segmented.

The abdomen is 10-segmented; of these the first eight bear the spiracles laterally. All the ten terga are clearly developed. The first sternum is atrophied; the remaining nine are well developed. The last or tenth segment bears laterally a pair of subanal styles and, lateral to them, a pair of cerci. It is not possible to distinguish the sexes in the soldier caste.

A fuller account will be published elsewhere.

Entomology Branch, K. S. KUSHWAHA,
Forest Res. Inst., Dehra Dun,
March 8, 1955.

ABNORMAL ARROWING IN *ERIANTHUS MUNJA* (ROXB.), JESW.

In sugarcane, Lyon¹ and one of the authors² recorded formation of foliar structures in whorls at apex in the place of an arrow. In this note a similar phenomenon in *E. munja* (Roxb.), Jesw. is reported.

In April 1953, an abnormally long arrow more than a metre in length (Fig. 1) was



FIG. 1. Abnormal arrow of *Erianthus munja*.

FIG. 2. A portion of the same magnified to show green foliaceous structures (a).

found to emerge in a clump of *E. munja* planted near the cage-house in the laboratory area. Detailed observations made in the following summer showed that three of the forms of *E. munja*, namely, W.S.7, W.S.14 and N/5, produced arrows which were greatly elongated (Table I). Some flowers were normal in all

respects and had functional sex organs, as shown by the percentage of anther dehiscence and pollen viability. But in a majority of them, not only had the glumes turned green, but other floral parts also got transformed into green foliaceous structures (Fig. 2).

TABLE I
Abnormal arrowing* in *Erianthus munja*
(Roxb.), Jesw.

Particulars	Type of arrow	W.S. 7	W.S. 14	N/5
Abnormal arrows measured		5	11	5
Maximum length of inflorescence in cm.	Normal	76.0	86.0	64.0
Average length of inflorescence in cm.	Abnormal	137.0	96.0	128.0
Minimum length of inflorescence in cm.	Normal†	56.8	77.8	54.4
	Abnormal	65.6	51.7	94.5
	Normal	48.0	45.0	47.0
	Abnormal	19.0	19.0	48.5
% Anther Dehiscence	Normal	99.3	90.7	100.0
	Abnormal	30.2	80.5	71.2
% Viable pollen	Normal	96.1	98.6	98.4
	Abnormal	48.4	88.1	88.6

* In Bihar *Erianthus munja* usually flowers in November-December. Abnormal arrowing was noted in April-May 1954.

† Average of 15 measurements.

E. munja, like sugarcane² appears to behave as a short-day plant. It is likely that the unfavourable long days of summer might have resulted in the transformation of floral structures into foliar ones and in the increased vegetative growth of the rachis.

Grateful thanks are due to Sri. K. L. Khanna for kindly providing facilities for this work.

Central Sugarcane S. L. SHARMA.
Res. Station, R. C. SRIVASTAVA.
Pusa, Bihar, March 8, 1955.

1. Lyon, H. L., *Haw. Plant. Rec.*, 1926, **31**, 249.
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CYTOLOGICAL AND EMBRYOLOGICAL INVESTIGATIONS IN THE ASCLEPIADACEÆ

THE family Asclepiadaceæ has not received much attention from embryologists and cytologists. Venkata Rao and Rama Rao¹ in a recent paper have reviewed the literature on the embryology of the family and described in detail the morphology and embryology of *Cryptostegia grandiflora* and *Caralluma attenuata*, while the cytology has been studied by Moyer,² Bowden³ and a few others.

Investigations on the embryology and cytology of the family are in progress in this laboratory for some time, and the present note gives

a brief account of the observations made so far.

The development of the female gametophyte in *Tylophora asthmatica*, *Pentatropis microphylla* and *Leptadenia reticulata* corresponds to the "Polygonum type". The ovules are anatropous and tenuinucellate. The archesporial cell is hypodermal in origin and directly functions as the megaspore mother cell. A normal linear tetrad of megaspores is formed, the chalazal of which functions. The mature gametophyte shows the presence of starch grains and the antipodals are ephemeral.

Cytological investigations show that meiosis is regular. The chromosome number of the plants, so far investigated, is as follows:

	n	2n
<i>Tylophora asthmatica</i> W. & A.	11	22
<i>Pentatropis microphylla</i> W. & A.	11	22
<i>Leptadenia reticulata</i> W. & A.	11	..
<i>Daemia extensa</i> Br.	11	22
<i>Pergularia pallida</i> W. & A.	..	22

It is interesting to note that polysomaty has been observed in roots of *Tylophora asthmatica*.

A full account of the investigations including other aspects will be shortly published elsewhere.

My thanks are due to Dr. I. Banerji, under whose guidance the investigation is being carried out.

Dept. of Botany, INDU SEKHAR BISWAS.
Calcutta University,
February 10, 1955.

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ENVIRONMENT AND RATE OF GROWTH OF EMBRYO IN *BRASSICA CAMPESTRIS* VAR. *TORIA*

THE present study was undertaken to understand the effect of temperature on fertilisation and the rate of growth of embryo in *B. campestris* L. var. *toria* Duth. & Full. Plants from colchicine-induced tetraploid cultures (11th and 12th generation) were chosen; the tetraploids were particularly well suited since they continue to flower for a longer period than the diploids, thereby rendering a study under widely differing conditions of temperature possible.

The material for study was fixed during two seasons. The first fixation was done in 1952 from 12th February to 3rd March and the

second in the next crop from 28th December to 27th January. The mean minimum and maximum temperatures during a day in the two fixation periods ranged from 54.0-78.6° F. in the former, and 41.8-65.8° F. in the latter. In both the years ovaries were fixed in the experimental plots at 3, 5, 10 and 20 days after pollination, and also after 30 days in the year 1953; they were processed by the usual paraffin technique and stained by the safranin and fast-green schedule. In all, about 285 ovules were examined and the observations are summarised in Table I. It should be mentioned that there was some variation in the stages that could be seen in different ovules fixed at the same stage. The stage shown by the maximum number of ovules was taken for purposes of comparison.

TABLE I

Days after pollination	Stage of embryo development	
	Early bloom (December-January)	Late bloom (February-March)
3	Fertilisation just over	Zygote ready to divide
5	2-3 celled proembryo	Dermatogen differentiated
10	Quadrant to octant stage	Heart stage
20	Heart stage	Cotyledons well formed and the embryo curved
30	Cotyledons well formed and the embryo curved	Stage not studied

Total number of ovules studied = 285. Number of plants used for the study: (i) early bloom = 2, (ii) late bloom = 2.

From Table I, it appears that the rate of development of embryo was faster in the late bloom fixations than in the early bloom ones. Such a difference may be attributed to the differences in the environmental conditions, mainly temperature and day length, prevalent during the two periods when the fixations were made. The late bloom period was characterised by warmer days and with longer light hours than the early bloom period. (In a highly cross-fertilised crop as *toria*, large variations in the growth rate are only to be expected. But as more than one plant was taken for comparison, the marked difference in the growth rate is attributable to environment. Plants among the late bloom group and early bloom group did not differ among themselves

widely, in this regard.) From the present study it would appear that the rate of growth of ovaries in late bloom is faster, presumably due to environmental conditions, consequently leading to their quick maturity. The observations are in accord with those made by Chinoy¹ who found that wheat varieties in late-flowering classes require fewer days for grain ripening compared to those in the early ones. Further he² found that when early varieties were induced to flower late the ripening period was shortened due to high temperature. On the other hand, when flowering was accelerated in late varieties the ripening period was considerably lengthened due to low temperature.

Incidentally, emphasis may be laid on the necessity of reporting the nature of environmental conditions at the time of fixation in such studies.

I am thankful to Dr. S. M. Sikka for encouragement, and to Dr. P. N. Bhaduri, Mr. S. S. Rajan and Dr. M. S. Swaminathan for their useful comments.

Division of Botany, Y. R. AHUJA.
Indian Agric. Res. Inst.,
New Delhi-12, January 17, 1955.

1. Chinoy, J. J., *Nature*, 1947, **159**, 442.
2. —, *Curr. Sci.*, 1949, **18**, 414.

UNEQUAL BIVALENT IN *EURYBRACHIS* (FULGORIDAE HOMOPTERA)

UNEQUAL bivalent is said to be of rare occurrence and the observations of the same were merely incidental to other investigations.² No record is available of a Hemipteran insect showing 'unequal bivalent'. In the spermatogenesis of *Eurybrachis apicalis* one unequal bivalent occurs.¹ This is the first record of a hemiptera, revealing the existence of an unequal bivalent in a natural population. It is very clear only at diplotene.

In this note an attempt is made to explain the nature and origin of the unequal bivalent in *Eurybrachis apicalis*. The explanation is based on an interesting configuration (Fig. 1), which is very clearly seen in a diplotene nucleus. The unequal bivalent is seen in association with a small bit of a chromosome. However, there is a single chiasma in between. Such a configuration was seen in only one diplotene nucleus, and hence its complete history cannot be worked out. Nevertheless, some conclusions are possible. They are as follows:

1. The small bit (p) belongs to the shorter partner (A_1 in Fig. 1) of the unequal bivalent.

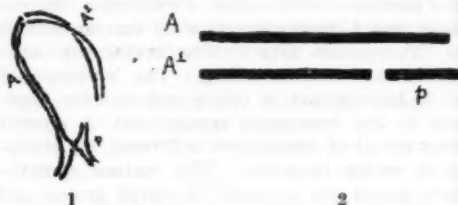


FIG. 1. Showing unequal bivalent in association with a small bit of a chromosome (p). A single chiasma is clearly seen in between them. A and A_1 represent the long and short partner of the unequal bivalent. p , represents a portion of chromosome A_1 and which is lost in most cases in *E. apicalis*, except the solitary case ($\times 3,200$).

FIG. 2. Represents diagrammatic representation of deletion of a small bit of a chromosome resulting in the unequal bivalent in *Eurybrachis*.

2. It points to the recent origin of the unequal bivalent in *Eurybrachis apicalis*. [While this small bit of a chromosome (p) is lost in almost all cases, at least in one solitary case it was present.]
3. The origin of unequal bivalent is due to a deletion which is heterozygous in nature (Fig. 2).
4. The portion which is lost is the euchromatic one, and not heterochromatic as reported in most cases.²

Dept. of Zoology, S. R. VENKATASUBBA RAO.
Birla College of Science,
Pilani, March 23, 1955.

1. Rao, S. R. V., *Studies on the Spermatogenesis of Indian Homoptera*. Part I. Meiosis in Two Species of *Eurybrachis* Chromosoma, 1955 (in press).
2. White, M. J. D., *Animal Cytology and Evolution*, 1954, 2nd Ed., Cambridge.

EFFECT OF NUTRITION AND STARVATION ON THE SUSCEPTI- BILITY OF *CORCYRA CEPHALONICA* STAIN. TO CARBON DISULPHIDE

SUN¹ observed that the rate of growth and susceptibility of larvae of *Tribolium confusum* Jaq. Duv. reared on eight different combinations of food, varied with the nature of food when they were subjected to carbon disulphide fumigation. After testing the effect of starvation with adults of *Sitophilus granarius* Linn. and *Tribolium confusum*, two of the Coleopterous pests of storage as test insects, he concluded that starvation may cause a slight lowering of the mortality so far as metabolism is

shorter
unequal

concerned while, on the other hand, starvation will decrease the vitality of the insects as a result of which their resistance to fumigants will decrease.

Laboratory experiments were carried out at the Entomology Division of the Indian Agricultural Research Institute with fourth stage caterpillars of *Corcyra cephalonica* Staint., one of the Lepidopterous pests of storage, as test insects. The caterpillars were reared on five different foods, namely, crushed groundnut, rice, wheat, cowpea and 'jowar'. With every food there were four different pre-treatment feeding methods, namely, (i) the caterpillars were reared on crushed groundnut mixed with yeast powder in the ratio of 1:30 parts of crushed food materials, (ii) reared on crushed food materials only, (iii) starved for 48 hours after feeding on crushed food mixed with yeast, and lastly, (iv) the caterpillars were starved for 48 hours after feeding on crushed food materials only. Twenty test insects reared on each of the five types of food and under four different types of treatments mentioned above were taken in cylindrical wire-gauze tubes (2" x 1.2") and were exposed to carbon disulphide at a concentration of 5 lb./1,000 c. ft. of space for 24 hours in an air-tight, cylindrical, iron bin. The fumigation was conducted at room temperature and humidity varying from 78-93° F. and 52-82% respectively. There were five replications in each of the treatments including the control.

It was observed that groundnut plays a definite part in the metabolism of *Corcyra* caterpillars which ultimately renders them more susceptible to carbon disulphide than other food materials. The comparative resistance or susceptibility of the caterpillars seem to depend on the chemical nature of the food. It was also found that with all the five foods tried *Corcyra* caterpillars reared on crushed food materials mixed with yeast powder were more susceptible, though insignificantly, than those reared on the same food without yeast. Generally speaking, starvation upto 48 hours before the fumigation increases the resistance of the above, reared both with and without yeast, to carbon disulphide. Greater mortality with than without food on the one hand, and the still further increase in mortality on the addition of yeast to the food tends to indicate that the increase in insects' inherent resistance due to increased vitality is not so much as increase in activities like respiration leading to greater intake of the fumigant. Lack of food,

among other things, decreases the rate of respiration. Consequently, the intake of the fumigant will be less as a result of which the mortality of the insect will also decrease. Prolonged starvation will decrease the vitality and might bring about greater mortality of the pest. Further studies will be continued.

Grateful thanks are due to Dr. E. S. Narayanan for his kind help in the above studies.

Ind. Agric. Res. Inst., SNEHAMOY CHATTERJI.
New Delhi, February 4, 1955.

I. Sun, Yun Pei, *University of Minnesota Agric. Exptl. Station Techn. Bull.*, 1947, 177, 104.

CHROMOSOME NUMBERS IN SESBANIA SPECIES

A study of the chromosome numbers of four *Sesbania* species, namely, *Sesbania speciosa*, *Sesbania sesban*, *Sesbania sericea*, obtained from Indonesia and *Sesbania macrocarpa* from the Indian Agricultural Research Institute, New Delhi, was undertaken. The somatic numbers of these species have been determined from actively growing root tips and are given in Table I. The chromosome counts are based on the maximum number of metaphase plates.

TABLE I

<i>Sesbania</i> species*	2n	Authors
<i>S. sesban</i>	.. 12	Jacob, 1941
<i>S. speciosa</i>	.. 12	do
<i>S. macrocarpa</i>	.. 12	Present count
<i>S. sericea</i>	.. 24	do

* Except *S. macrocarpa*, the rest are suitable as green manure crop.

The chromosome number in the genus *Sesbania* Pers. was first reported by Kawakami.¹ He reported the haploid number of *Sesbania aculeata* as 16. But Haque² and Sampath,³ while working on the same species reported the diploid number as 24. Jacob⁴ while studying the genus *Sesbania* reported the diploid number of *Sesbania speciosa* and *Sesbania sesban* as 12 each. The present counts confirm the chromosome number of *Sesbania speciosa* and *Sesbania sesban*. As far as we are aware, the chromosome numbers of *Sesbania macrocarpa* and *Sesbania sericea* were not reported on earlier.

From the present work and that reported by earlier workers, it would seem that the basic number of the genus *Sesbania* is 6.

Further cytological studies of species of *Sesbania* are in progress.

Govt. Main Agril.

M. S. PAWAR.

Expt. Station,

S. A. KULKARNI.

Himayetsagar,

Hyderabad-Dn.,

March 16, 1955.

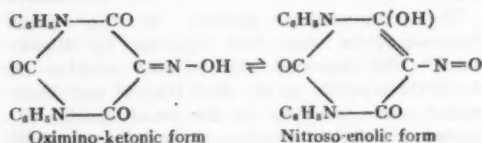
1. Kawakami, J., *Bot. Mag. Tokyo*, 1930, **44**, 319, 28.
2. Haque, A., *Curr. Sci.*, 1946, **15**, 78 ; 287.
3. Sampath, S., *Ibid.*, 1947, **16**, 30.
4. Jacob, K. T., *Bibliogr. Genetica (Grawentage)*, 1941, **13**, 225.

METALLIC COMPLEXES FORMED BY DIPHENYL-VIOLURIC ACID

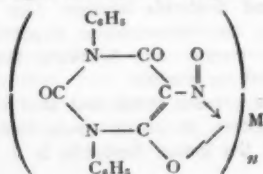
DIPHENYL-VIOLURIC ACID has been found to form complex compounds with many metals. The compounds which are highly coloured, were obtained by addition of concentrated solutions of soluble salts of the metals in water to saturated aqueous solutions of the ammonium salt of diphenyl-violuric acid. The ammonium salt was obtained by dissolving diphenyl-violuric acid in ammonium hydroxide in which it dissolves readily. The solution on concentration on a water-bath, deposited pink crystals of the ammonium salt. The ammonium salt was found to be soluble in water.

Diphenyl-violuric acid was obtained by the action of nitrous acid on 1:3 diphenyl-barbituric acid, synthesized by the action of diphenylurea on malonic acid in presence of chloroform solution of phosphorus oxychloride.

The metallic salts of diphenyl-violuric acid are probably internally complex compounds. The acid molecule in its nitroso-enolic form contains a replaceable hydrogen atom, which can be replaced by metal atoms during salt formation.



On the other side, the nitrogen atom of the nitroso group, can combine with the metal atom by co-ordination, and ring closure can thus be brought about, resulting in the formation of inner complexes. The compounds can be formulated as in the above formula.



tion of inner complexes. The compounds can be formulated as in the above formula.

In the above general formula, 'M' represents the metal atom whose valency is n .

The properties of the salts are given in Table I. The empirical formula in each case was derived as a result of careful analyses of percentage of metal and percentage of nitrogen.

TABLE I
Properties of salts

Compounds*	Colour in solid state	Decomposition temp. °C.	Absorption maxima in acetone in $m\mu$
CuD†	Emerald green	240	652
CuD ₂	Leather brown	175	473
AgD	Pale violet	160	560
AuD ₃	Orange brown	153	485
CaD ₂	Pale pink	159	520
BaD ₂	Deep pink	> 290	540
HgD	Pale pink	180	515
AlD ₃	Crimson	115	550
CeD ₃	Yellowish brown	> 290	450
TiD ₄	Grey	95	420
ZrD ₂	Light yellow	> 290	450
ThD ₂	Brownish	> 290	475
SnD ₂	Pink	140	520
PbD ₂	Flesh coloured	190	515
CrD ₂	Greenish blue	153	645
UO ₂ D ₂	Sulphur yellow	220	420
FeD ₂	Indigo blue	220	630
FeD ₃	Dark bluish green	172	655
CoD ₂	Brown	202	485
NiD ₂	Brown	> 290	498
PtD ₄	Pale pinkish brown	214	510
BiD ₃	Salmon	> 290	525
Cu ₃ D ₄ ‡	Olive green	..	650

*D = Diphenyl violurate; † (with excess of CuSO₄)

‡ From boiling solutions using excess of CaSO₄.

Full details of the above investigations will be published elsewhere.

Chemistry Dept.,
University of Delhi,

R. P. SINGH.

Delhi-8, February 24, 1955.

A NEW ORGANIC REAGENT FOR GRAVIMETRIC ESTIMATION OF COPPER

A LARGE number of reagents have been used for various types of estimations in recent times. In the case of copper, α -benzoinoxime, quinaldine acid, salicylaldehyde, etc., have been used with success. It has been found that diphenyl thio-violuric acid can be used equally satisfactorily for this purpose.

The reagent, diphenyl thio-violuric acid, was used in the form of its ammonium salt. The preparation of the acid is similar to that of diphenyl violuric acid described in an earlier note.¹

The ammonium compound was then dissolved in warm water and filtered if necessary and the clear filtrate (about 0.8% solution of the ammonium salt) was used for the estimations. On adding an excess of the aqueous solution of the ammonium salt to a solution of a copper salt, the latter is precipitated in the form of a complex.²

Exact conditions for the estimation of copper by the gravimetric method have been investigated. It was found that copper can be quantitatively estimated by adding an excess of the reagent solution between the pH range of 7.2-8.0. As a result of ten estimations within this range of pH, the average error came to about 0.3%.

The conditions for the quantitative precipitation of copper in presence of other cations are under investigation, full details of which will be published elsewhere.

Dept. of Chemistry,
University of Delhi,
Delhi-8, February 24, 1955.

R. P. SINGH.

1. Singh, R. P., *Curr. Sci.*, 1955, **24**, 208.
2. Ghambhir, I. R. and Singh, R. P., *Proc. Ind. Acad. Sci.*, 1946, **23A**, 330.

OCCURRENCE OF SCOLYTID BEETLE ON STORED SWEET POTATOES

APART from *Cylas formicarius*, Fb. there appears to be no record of any other insect doing serious harm to stored sweet potatoes in this country. Recently the author came across a species of shot hole borer, *Scolytidae*, causing considerable damage to stored tubers of sweet potato, which were part of a consignment purchased from the local market at Coimbatore and kept under observation at the insectary. The specimens were sent to the Commonwealth Institute of Entomology, London, and also to the Forest Research Institute, Dehra Dun, where it was identified as a species of *Stephanoderes* of the family *Scolytidae*. As the insect is found to be a new pest on sweet potato, the following preliminary observations are recorded on its life-history and habits.

The adult is a dark brown beetle measuring about 1.9 mm. in length. Both the adults and the grubs of this beetle bore through the contents of fresh tubers converting the same into a powdery mass in due course. A heavily infested tuber shows a circuitous system of tunnels harbouring numbers of the beetle in various stages of development. The damage

by this beetle is distinguishable from that of *Cylas formicarius*, Fb., in that the tunnels are very narrow and filled up with a powdery stuff, whereas in the latter case the tunnels are distinctly larger and are also badly stained with excrement. Another characteristic symptom of the damage by this Scolytid beetle is the ejection of powdery material through the bore-holes by the adults as noticeable in the case of other Scolytid beetles, which is not found in the case of the weevil damage.

As regards the life-history of this beetle, the female lays eggs in irregular longitudinal tunnels excavated by it in the tissue. The eggs are laid in rows close together along both sides of the tunnel, each egg being packed tightly in place with powdery material. The egg is pearly white, oblong oval and measures, on an average, 0.6 mm. in length and 0.3 mm. in width. The eggs hatch in 5-7 days and the newly hatched larva, which is a whitish, legless grub with a pale brown head and measuring about 0.8 mm. in length, bores through the tissue in all directions and becomes full grown in 18-27 days. The full grown grub is whitish and subcylindrical with a harder light brown head capsule and much wrinkled body and measures 2.2 mm. in length. Pupation takes place in a cavity at the end of larval burrow. The pupa is naked and whitish in colour becoming slightly darker upon maturity and is about 1.9 mm. long. The pupal stage lasts for 5-7 days. The adult just after transformation is soft and light in colour. When fully developed they emerge out through holes bored through outer skins. Many individuals emerge through the same exit holes. The total life-cycle worked out with reference to 40 individuals ranged from 28-41 days. The longevity of the beetle for both male and female was found to range from 42-68 days under laboratory conditions. The egg-laying capacity varied from 71-158 eggs. The pest was not found in the field in any of the villages from where the tubers are brought to the local market.

The author's sincere thanks are due to Sri. K. P. Anantanarayanan, for valuable suggestions in preparing this note.

Division of Entomology, T. R. SUBRAMANIAN.
Agric. College & Res. Inst.,
Lawley Road P.O., Coimbatore,
February 8, 1955.

SEPTORIA LEAFSPOT OF *MANILKARA HEXANDRA*

Manilkara hexandra Dubard. (*Mimusops hexandra*) is an ever-green tree, the seedlings of which are used as root stock for grafting *Achras sapota* L. During January 1955, the leaves were found infected by a fungus causing leaf spots. On examination the fungus was found to be a species of *Septoria*. The symptoms of the disease and the characters of the causal fungus are described below.

Septoria hexandrae—Kandaswamy and Sundaram Spec. nov.

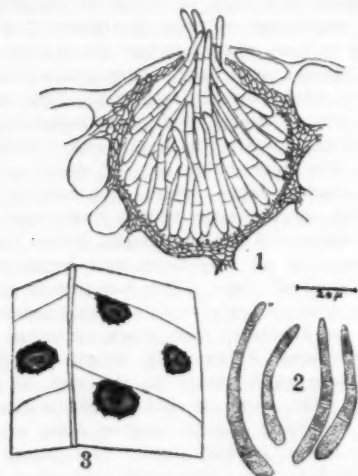


FIG. 1. Section through a pycnidium. FIG. 2. Conidia. FIG. 3. A portion of the leaf showing the spots (enlarged).

Spots numerous, amphigenous, round to irregular, cacao brown in the middle with blackish purple margin, 2-5 mm.; pycnidia mostly on the lower surface, 5 or more in each spot, producing black slender thread-like spore horns up to 0.5 mm. long, subepidermal, immersed in the tissues, globose to subglobose, ostiolate, $62-93 \times 57-77 \mu$ with a peridium of 2-3 layers of light brown cells; pycnidiospores long, cylindrical, slightly bulged at the base, curved, septa 2-5, light brown, $50 \times 3 \mu$ ($36-68 \times 2-4-5$), produced on very short stalks.

On living leaves of *Manilkara hexandra* (Sapotaceae), Botanical Garden, Coimbatore, 29-1-1955, M. Kandaswamy and N. V. Sundaram.

The infection spots are very prominently seen by their blackish purple appearance with a cacao brown centre. The colour is found more intensive on the upper surface. On the lower surface of the leaf in the middle of the spots are found black dot-like eruptions from which conical curved outgrowths made up of numerous conidia held together by the mucilaginous excretion of the fungus are observed. The septation in the spores is visible only under the oil immersion lens. From the available literature there is no record of this fungus on this host genus and hence it is described as a new species.

Agric. College & Res. Inst., M. KANDASWAMY,
Lawley Road P.O., N. V. SUNDARAM,
Coimbatore, February 26, 1955.

WILT OF GRAM (*CICER ARIETINUM* L.) IN BIHAR

In heavy soils of South Bihar, an unusual wilting of gram plants has been observed for the last two years. The disease was responsible for the death of 5-10% of the plants. In badly infected soils, the infected plants either did not tiller at all or there were only 1-2 tillers per plant. The infected plants appear sickly and die very slowly. The hyphal strands creep up the stems of infected plants and can be prominently seen in the early stages. Later brownish streaks with a few cinnamon-brown sclerotia may be found on the basal portion of the stems.

On isolation from the infected portions of the plants, mostly cultures of *Ozonium texanum* Neal and West, probably identical with var. *parasiticum* Thirumalachar were obtained. In sterile soils inoculated with the fungus, heavy mortality of gram seedlings resulted. Many of the seedlings failed to come out of the soil and a few which succeeded in so doing also died subsequently.

The pathogenicity of gram seedlings to the fungus (*Ozonium texanum*) has been confirmed by Shri B. P. Chakravarti during the course of further work on this disease.

Division of Plant Pathology, J. N. MISHRA,
Bihar Agric. Res. Inst.,
Sabour (Bhagalpur),
December 28, 1954.

REVIEWS

The Optical Properties of Organic Compounds.

Second Edition. Enlarged and Revised. By A. N. Winchell. (Acad. Press Inc., New York), 1954. Pp. xviii + 487. Price \$12.00.

This new edition of Winchell's Handbook contains optical data on more than 2,500 organic compounds, of which nearly a thousand have been added to the previous list. The compounds are arranged according to the method adopted in the fourth edition of Beilstein, so that organic chemists used to the latter will have no difficulty in looking up the data. In addition to the optical data a short summary of the morphological and X-ray data are also given (wherever available).

The main purpose of the book is to enable identification of the compounds by optical methods. For this purpose, two determinative tables are given based on the higher or the lower of the measured refractive indices. Two large diagrams are appended to the volume, which would be of great assistance in identification from the optical data.

The present volume is stated to contain all information published up to the end of 1952. Compilations of this type are of inestimable value, particularly since such data would be found only as part of a long paper and would not be indexed anywhere. The printing and get-up are excellent and the contents are remarkably free of errors, the only slip which the reviewer noted being the symbol $P_{2,1}a$ instead of $P_{2,1}/a$ for the space group of benzoin in p. 108. The volume is warmly commended to all libraries in physics and chemistry.

G. N. RAMACHANDRAN.

A Text-Book of Radar. Second Edition. Edited by E. G. Bowen. (By the Staff of the Radiophysics Laboratory, C.S.I.R.O., Australia), 1954. Pp. xiii + 617. Price 45 sh.

This is practically a reprint of the first edition which was published in Australia in 1947. The last three chapters, dealing with practical applications, have however been rewritten. The military applications have been compressed, while a more detailed account is given of the civil uses. A short account is also added regarding other applications in physics, e.g., in ionospheric research, in the study of meteors, in meteorology, in radio-astronomy and in

microwave spectroscopy. It is interesting to note that some of the most accurate values for the velocity of light have been obtained by means of Radar.

The chapters in the book are contributed by various members of the staff of the C.S.I.R.O. In spite of this, the contents have been well edited, and the volume can be used as a regular text-book by post-graduate and research students. The fundamentals are treated in good detail and numerous references are given to the original literature. Physicists and engineers who wish to keep abreast of the recent developments in the region of microwaves will find this to be an excellent book for reference.

Mechanism of Polymer Reactions—High Polymers, Vol. III. By G. M. Burnett. (Interscience Publishers, Inc.). Pp. xv + 493. Price \$11.00.

The original volume 'High Polymeric Reactions' by Mark and Ruff was published at a time when the kinetics of condensation and addition polymerization was not completely understood. In the past decade or so, high polymer chemistry has taken dramatic strides and a full analysis of radical polymerization reactions and evaluation of rate constants of the individual steps in the chain process have been achieved. This new edition contains a wealth of data and information to completely replace the old one.

The first two chapters on general kinetics and experimental methods in radical polymer reactions are brief but interesting. The general principles and nature of the addition reactions and their kinetic analysis, are elucidated in the next two chapters. The chapters on gas phase and homogeneous liquid phase polymerization and the evaluation of rate constants in respect of various monomers contain information nicely summarised for a high polymer research chemist. Copolymerization and heterogeneous liquid phase polymerizations as well as ionic and condensation polymerizations receive treatment which might appear scanty, but nevertheless modern and full.

An account of the kinetics of radical depolymerization processes has been given for the first time in this book. Starting with a simple degradation reaction, hydrolytic

degradation of cellulose, the complete kinetic analysis of degradation of cellulose and radical chains of various monomers has been dealt with.

The mathematical treatment throughout the book is very detailed and embodies the full significance of the complexities of chain reactions. The topics of branching and cross-linking are slightly touched upon. With such valuable and up-to-date information the book will be of special value to physical chemists and particularly to high polymer research chemists.

M. SANTHAPPA.

Electromagnetic Theory. By V. C. A. Ferraro, University of London. (The Athlone Press), 1954. Pp. viii + 555. Price 42 sh.

This is admirably suited to be a text-book for students taking Electromagnetic Theory as their special subject for the Honours or Masters Degree in Mathematics. Part I deals with the basic principles of electrostatics and electrodynamics. Part II on boundary-value problems is concerned with the mathematical theory of determining potential distributions given specific boundary conditions, in particular the use of spherical and spheroidal harmonics. Part III contains a discussion of electromagnetic phenomena, with particular stress on the essential mathematical aspects, leaving out topics of purely physical interest such as the electrodynamics of moving media and the electron theory of dispersion.

The treatment is throughout very clear and elegant and the printing leaves nothing to be desired. Vector notation has been used systematically, and the first chapter covers those portions of this subject which are needed later. Each chapter has, appended to it, a large number of examples, and these greatly add to the usefulness of the book as a text-book. Although written specifically for the mathematician, it will also serve well as a reference book for physicists and engineers.

Mass Balancing of Aircraft Control Surfaces. By Templeton. (Chapman & Hall), 1954. Pp. x + 241. Price 35 sh.

A good amount of work has been done on the subject of mass balancing of aircraft control surfaces, and a need for a systematic presentation of the published data in the form of a text-book has long been felt. The monograph published under the authority of the Royal Aeronautical Society can easily meet the requirements of a text-book on that subject.

Part I of the book provides in a lucid style an understanding of the basic principles employed in the application of mass balancing to prevent flutter of aircraft control surfaces. Part II of the book gives a historical review of the work done in Britain on that subject with additional chapters on design requirements for mass balancing and the procedure adopted in practice. Another chapter gives the various methods adopted for mass balancing. Part III gives a short note on the possible future developments and discusses the limitations in and alternatives for mass balancing.

Unfortunately the monograph is limited purely to British work on the subject. Yet it is adequate for the requirements of a text-book for a Graduate in Aeronautical Engineering. The recent developments on the subject in the United States of America could have been added in Part III. In spite of this limitation, the book, because of the good presentation of the subject-matter, should be welcome to all those engaged in Aeronautical Engineering either in industries or educational institutions.

N. SRINIVASAN.

Chemical Pathways of Metabolism, Vol. I. Edited by D. M. Greenberg. Pp. xi + 460. Price \$ 11.00; Vol. II: Pp. x + 383. Price \$ 9.50.

Intense research activity in biochemistry in various directions has necessitated in recent years the publication of books containing review articles, which aim at integrating the work carried out on different aspects of one and the same problem. The efforts of Dr. Greenberg in editing two such volumes dealing with chemical pathways of metabolism may be considered as very praiseworthy indeed, particularly in the context of the wide variety of subjects covered in this extensive field of biochemical investigation. The topics which have been dealt with in Volume I are, Free energy and metabolism, by A. B. Pardee; Enzymes in metabolic sequences, by D. E. Green; Glycolysis, by P. K. Stumpf; The tricarboxylic acid cycle, by H. A. Krebs; Other pathways of carbohydrate metabolism, by S. S. Cohen; Biosynthesis of complex saccharides, by W. Z. Wasid; Fat metabolism and acetoacetate formation, by I. L. Chaikoff and G. W. Brown Jr.; and Sterol and steroid metabolism, by K. D. Fukushima and R. S. Rosenfeld. Three of the eight chapters in the second volume dealing with carbon catabolism of amino acids, synthetic processes involving amino acids and the

metabolism of sulphur containing compounds have been written by the editor himself, while the remaining five are by (i) P. P. Cohen on nitrogen metabolism of amino acids, (ii) H. Borsook on enzymatic synthesis of peptide bonds, (iii) M. P. Schulman on purines and pyrimidines, (iv) L. A. Heppel on nucleotides and nucleosides, and (v) S. Granick on metabolism of leme and chlorophyll. Though some of these articles are short and the literature covered in the first volume is only up to the middle of 1953, the treatment of the different topics is uniformly good. Special mention may, however, be made of the very valuable contribution of Krebs on the tricarboxylic acid cycle, and the comprehensive review on the biosynthesis of complex saccharides by Hassid. Granick has also dealt in great detail on the metabolic studies of leme and chlorophyll.

An error has crept in on p. 165 in the second volume, wherein it is stated that the structural formula of coenzyme A is shown in page 149, whereas no formula of any kind is given in the page referred to. In the chapter on the metabolism of amino acids, the work of A. Butenandt and his associates could have been described in the section dealing with tryptophane metabolism. However, subjects like glycine-serine and other interconversions, the biosynthesis of branched chain amino acids and the aromatic amino acids have been written by Dr. Greenberg in an elegant fashion and constitute a veritable mine of useful information. One may perhaps take exception to the practice of some of the authors quoting from proceedings of learned societies since such references are not easily available for consultation and more often do not give much detailed information. However, in spite of these minor drawbacks, the volumes as a whole are excellent in their scope and content, and very well got up. They should help biochemists all the world over in their investigations of the several pathways of metabolism. To the teacher in biochemistry, the two volumes are invaluable for his lectures on the various aspects of metabolism.

P. S. SARMA.

The Production and Use of Power Alcohol in Asia and the Far East. (The Economic Commission for Asia and the Far East, United Nations), 1954. Pp. 445. Price not given.

The above is a report on the Regional Seminar on the production and use of power alcohol held in Lucknow from 23rd October to 6th November 1952. It covers the deliberations

and discussions of the participating experts in the Seminar, and will be of immense use to specialists and industrialists associated with power alcohol.

Liquid-Liquid Extraction. By L. Alders. (Published by Elsevier Publishing Company, Amsterdam), 1955. Pp. x + 206. Price 32 sh.

The book provides systematic and detailed knowledge of the theory of liquid-liquid extraction and describes the various methods of investigation concerned with liquid-liquid extraction processes. A survey is given of the principal extraction procedures, viz., cross-current extraction, two solvent extraction and extraction with reflux. Experimental methods have been suggested for determining the phase equilibrium data which are necessary for the design calculations. The author has not dealt with any special features of the Chemical Engineering side of liquid-liquid extraction, nor is any commercial equipment described. Information on such subjects, however, is already available in "Liquid Extraction" by R. E. Treybal, "Absorption and Extraction" by T. K. Sherwood and R. L. Pigford, etc. The author has treated this specialised subject in the simplest possible manner and the book offers a great wealth of information. It is an excellent manual of technique for all investigators concerned with liquid-liquid extraction and will be very useful to all chemical investigators in research institutions and industries interested in this field.

G. S. LADDHA.

Books Received

The Relation of Immunology to Tissue Homotransplantation. By J. M. Converse and 34 others. (*Annals of the New York Academy of Sciences*, Vol. 59, Art. 3). Pp. 190. Price \$4.00.

Ionizing Radiation and the Cell. By L. F. Nims and 22 others. (*Annals of the New York Academy of Sciences*, Vol. 59, Art. 4). Pp. 200. Price \$4.00.

Protective Current Transformers and Circuits. By P. Mathews. (Chapman & Hall), 1955. Pp. xv + 253. Price 36 sh.

Precast Concrete. By Kurt Billig. (Macmillan & Co.), 1955. Pp. xvi + 341. Price 32 sh.

Progress in Nuclear Physics, Vol. 4. Edited by O. R. Frisch. (Pergamon Press), 1955. Pp. vii + 379. Price 70 sh.

Technical Publications—Their Purpose, Preparation and Production. By C. Baker. (Chapman & Hall), 1955. Pp. xiii + 302. Price 36 sh.

Integers and Theory of Numbers. (Scripta Mathematica Studies, No. 5). By Abraham A. Fraenkel (Scripta Mathematica, 186th Street, Amsterdam Avenue, New York 33, N.Y.), 1955. Pp. 102. Price \$2.75.

Introductory Applied Physics. By Norman C. Harris and Edwin M. Hemmerling. (McGraw-Hill), 1955. Pp. viii + 729. Price \$6.75.

Some Beautiful Indian Trees. By E. Blatter, Water S. Millard and W. I. Stearn. (Bombay Natural History Society, 114, Appollo Street, Bombay), 1954. Pp. xv + 165. Price Rs. 20 or 30 sh.

Aromatic Compounds—Chemistry of Carbon Compounds, Vol. III. Edited by E. H. Rodd. (Elsevier Publishing Co.), 1954. Pp. xxiv + 686. Price not given.

Advances in Geophysics, Vol. 2. Edited by H. E. Landsberg. (Academic Press, Inc.), 1955. Pp. x + 286. Price \$7.50.

SCIENCE NOTES AND NEWS

Preservation of Palm Juice

P. S. Murthi and C. J. Dasa Rao, Department of Chemical Technology, Andhra University, in the course of a communication to the *J.S.I.R.* (1955, 14 A, 250) observe that the usual method followed by the tapper consists in adding lime to the earthen pots before they are used for collecting the juice and after 12 hr., the juice is removed from the pot for further processing. The juice collected usually starts fermenting after an hour or two. The amount of lime employed by the tapper varies from 0.04 to 0.12% of CaO on the weight of juice. With a view to determine the optimum amount of lime to be employed, experiments were carried out using different concentrations of lime. It was found that addition of lime in a concentration of 0.55% CaO on the weight of fresh juice prevented it from fermenting. The juice remained sweet for 40 hr. and there was no fall in its sucrose content. Higher concentrations of lime had no additional advantage.

Polyspory in *Lantana camara* L.

S. L. Tandon and P. N. Bali, Department of Botany, University of Delhi, writes as follows:

In addition to the normal tetrads, 5-10 spores per pollen mother cell were also present in the naturally existing triploid of *Lantana camara* L. Polyspory in this case has been found to be due to irregularity in chromosome distribution and the occurrence of lagging chromosomes resulting in a high degree of sterility. The environmental factor as the cause of polyspory has been ruled out as the diploid in which the distribution of chromosomes was regular and which did not show

polyspory was growing just by the side of the triploid showing polyspory.

Models of Molecular Structure

Many research workers have been aware of the value of the space-filling atomic models developed by G. S. Hartley and C. Robinson at the Maidenhead Laboratory of Courtauld, Ltd. These models are now available commercially from the firm of Griffin and Tatlock (Kemble Street, Kingsway, London, W.C.2). Primarily designed for research, where accurately made models are required from which quantitative deductions of molecular geometry can be made, the models are also eminently suitable for lecturing purposes. Important contributions to peptide and protein chemistry have already been made with the aid of these models. It is likely that their application in other fields will be equally fruitful.

Occurrence of *Cistanche* Species on *Salvadora persica*

R. A. Patel and R. M. Patel, Institute of Agriculture, Anand, Bombay, state that besides the occurrence of the root parasites *Crenata*, *Schweinfurthii* and *Ramosa* on the cultivated as well as on wild plants, recently a parasite *Cistanche tubulosa* Wight has been observed by the authors on the roots of *Salvadora persica* trees in the Kaira District of Bombay State. This would appear to be the first record of its occurrence in that locality.

Penetrometer

A new instrument which provides a method of measuring the compactness of underwater sediments without disturbing them has been developed at the University of Rhode Island

under contract with the Office of Naval Research and the Navy Hydrographic Office. The new instrument, a penetrometer, consists of a steel tube with a probe on the end which is driven through a hollow shaft into the bottom by a motor and a mechanism which measures and makes a permanent record of resistance at depths up to 200'. The working mechanism is mounted on a 5-foot frame resembling a bell buoy. It weighs 145 lb. without the lead weights which hold it in position under water. The motor which drives the probe is equipped with a water-tight cover which can be pressurized. In addition to probing the ocean bottom, the penetrometer may be used on land as a soil-mechanics instrument for highway planning and foundations.

U.S. Atomic Energy Reports on Microcards

All unclassified reports of the United States Atomic Energy Commission are being put on microcards and made available as widely as possible. Some 9,500 unclassified reports have been published since the beginning of the Commission's operation, and more are being issued at the rate of 1,800 reports a year.

Most of the Commission's reports fit on one card, and it is estimated that the cost of each card will be about 20 cents. To subscribe for all the reports published to date, therefore, would cost approximately \$2,000. Reports issued currently, about 1,800 per year, would cost \$400 yearly. Orders will be accepted for reports on specific subjects, as well as for individual reports, but the latter will cost about 50 cents per microcard, due to the extra handling costs involved.

Symposium on *Rauwolfia serpentina*

A symposium on *Rauwolfia* will be held under the auspices of the Pharmaceuticals and Drugs Research Committee in September 1955. The venue of the symposium will be announced later. The following aspects of *Rauwolfia* will be discussed: (i) Botany and Pharmacognosy, (ii) Chemistry of active principles, (iii) Pharmacological action of active principles, (iv) Therapeutic uses, and (v) Manufacture and standardization of *Rauwolfia* preparations.

A Marine Bacteriophage

One of the main difficulties in the study of marine bacteria, and particularly of those types which constitute the flora of fresh and spoiling fish, is that of identification and classification. This is due to the negative results given by these bacteria in most common biochemical tests. In the course of a

communication in *Nature* (1955, 175, 690), R. Spencer describes the use of a bacteriophage which might help with this difficulty. Attempts were made to isolate bacteriophages active against certain marine bacteria associated with fish, and particularly against certain luminous bacteria probably identical with *Photobacterium phosphoreum* (*Bacterium phosphoreum* Bergey). These luminous bacteria have been shown by various workers to constitute a considerable part of the flora of many species of fish.

Height of Mount Everest

The height of Mount Everest has long been a subject of much discussion. Its accepted height is 29,002', but several other values have also been quoted from time to time. *Technical Paper No. 8* of the Survey of India deals with the work undertaken by the Geological Survey of India during 1952-54 for determining the height of Mount Everest accurately. The new value for the height of the peak, obtained on analysis and reductions of new data from these investigations, is 29,029' which, it is hoped, is not likely to be in error by more than 10'.

Pole of Rotation of Venus

It is reported by Gerard P. Kuiper, associated with the University of Chicago's Yerkes Observatory (Wis.) and the McDonald Observatory (Tex.), that the pole of rotation of Venus is tipped at an angle of 32° to its path, compared with the earth's 23.5°. Further, Kuiper's observations indicate that a day on Venus, one rotation upon its axis, is not almost a year of earthly time, as some text-books estimate, but probably not more than a few weeks. He believes that this rapid rotation is shown by the daily changes that occur in the dark and light bands with which the planet is covered. The bands, usually three bright ones and three dark ones, are thought to be parallel to the equator of Venus.

Dr. K. S. Krishnan

Dr. K. S. Krishnan, Director, N.P.L., New Delhi, who presided over the deliberations of the International Advisory Committee for Scientific Research—the programme of Natural Sciences (UNESCO) at Pallanza, has been elected the Chairman of this Committee.

New Director for European Centre for Nuclear Research

Dr. Felix Bloch of Stanford University, who a few months ago accepted the Directorship of

the European Centre for Nuclear Research in Geneva, has asked to be relieved of his duties there. He will be succeeded by Dr. C. J. Bakker, Professor of Physics at the University of Amsterdam, who is at present a member of the organization's directorate and a Director of the Synchrocyclotron Division.

Award of Research Degree

The Annamalai University has awarded the Ph.D. Degree in Zoology to Sri. Joseph Jacob for his thesis entitled "Some Aspects of Experimental and Comparative Embryology Molusca (Studies in the Cytology of Melaniidae with special reference to Parthenogenesis and Polyploidy)".

The University of Calcutta has awarded the Ph.D. Degree to Shri A. G. Datta for his thesis entitled "Action of Some Antimalarial Drugs on Enzymes of Tricarboxylic Acid Cycle" and to Shri Achintya Kamal Sen for his thesis entitled "8-Aminoquinolines as Possible Antimalarials".

Cell Division through Chemical Activation

A chemical that makes cells divide has been isolated in pure crystalline form by a research group at the University of Wisconsin. Carlos Miller and Folke Skoog of the Botany Department, and Malcolm von Saltza and F. M. Strong, of the Department of Biochemistry, have named the compound 'kinetin'. It has a molecular weight of only 215, and its chemical formula indicates that the molecule contains 10 atoms of carbon, 9 of hydrogen, 5 of nitrogen, and 1 of oxygen. Kinetin is obtained from desoxyribonucleic acid.

When just a trace of the new substance is added to culture mediums for plant tissue cells that are long past the growth period, the cells divide and new cells continue to be formed indefinitely so long as kinetin is in the medium. The signs of growth usually show up within 3-5 days. When the rejuvenated tissues are placed in another medium that lacks kinetin, they stop growing. In order that continuous growth occur, the hormone auxin must also be added to the medium. Similar effects of cell division have been obtained with extracts from both plant and animal sources, including herring sperm, calf thymus glands, brewer's yeast malt and coconut.

Hindustan Machine Tools Factory

The Hindustan Machine Tools Factory at Jalahalli near Bangalore went into production recently. The 9-crore project is the result of a technical assistance agreement signed between the Government of India and Messrs. Oerlekon Machine Tool Works, Buelrle & Co., Zurich, in April 1949. The Swiss firms are providing the technical 'know-how' of machine tool manufacture, equipment, jigs, tools and fixtures, duplicate patterns, operation schedules, etc., and have also sent out technical experts and keymen to enable the factory to be set up.

The factory is at present engaged in the manufacture of precision type machine tools commencing from 8½" centre lathes and will gradually take up other items like large type lathes and milling machines in different stages. The target of 400 lathes per year is expected to be reached within a period of three years.

Organic Chemistry Symposium of the ACS

The Fourteenth National Organic Chemistry Symposium of the American Chemical Society was conducted under the auspices of the Organic Chemistry Division of the ACS, in the Purdue University, Lafayette, Indiana, starting from June 13. Over a thousand chemists from all over the U.S.A. and a few from other countries attended the symposium. The various papers presented in the symposium covered the more recent advances in organic chemistry. The subjects discussed were: Stereo-specific syntheses by Gilbert Stork, Stereo-specific and non-specific elimination reactions by Stanley Cristol, Mechanism of chromic acid oxidation of alcohols by Westheimer, New small ring compounds by John Roberts, Chemistry of medium-sized ring compounds by Aurthor Cope, Transannular nitrogen-carbonyl interactions by Nelson Leonard, Recent developments in the chemistry of free radicals in solutions, and Stereochemistry of some replacement reactions in inorganic complexes. Besides, some papers of biochemical interest such as Total synthesis of steroids, Hormones of the posterior pituitary glands, and Photosynthetic carbon cycle were also presented. Prof. Roger Adams was the guest speaker to give the "Reminiscences", and he gave a brief picture of the story of evolution of modern organic chemistry.

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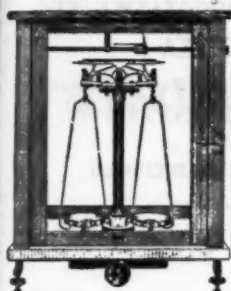
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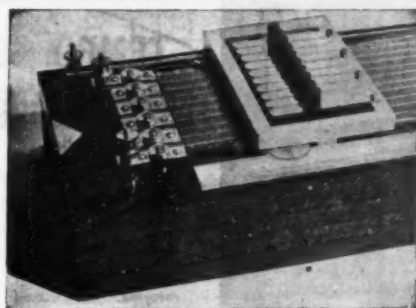
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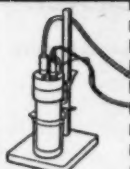
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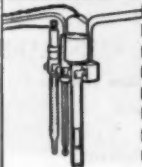
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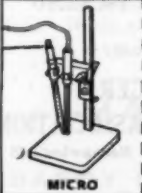
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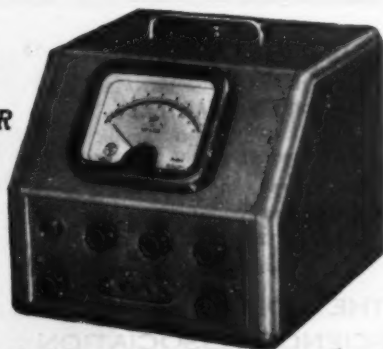
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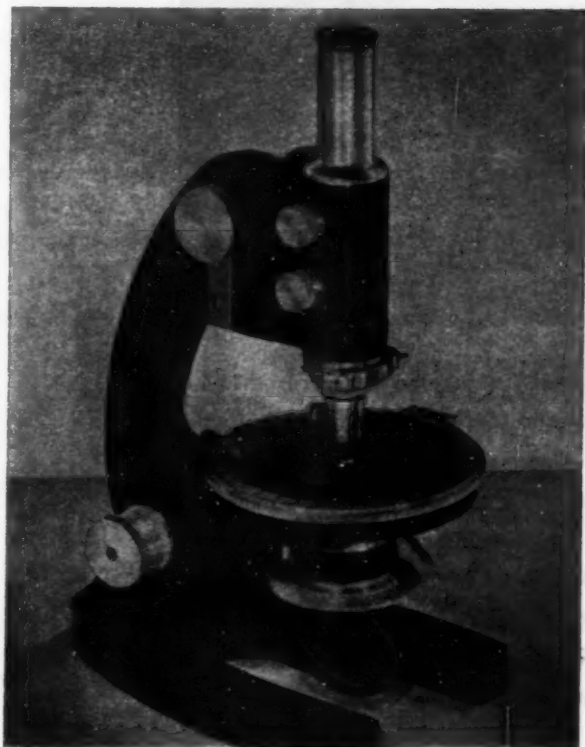
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